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# ELECTRICAL REVIEW

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LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C.4. SUBSCRIPTION per annum, Postage inclusive, in Great Britain, £1 1s. 8d. Canada, £1 2s. 10d. ($5.80); to all other countries, 30s.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
Telegraphic Address: "Ageekay, Cent., London." A B C Code. Telephone Nos. City 997; Central 4425 (Editorial only).

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*Advertisement Index, see page xxviii.*

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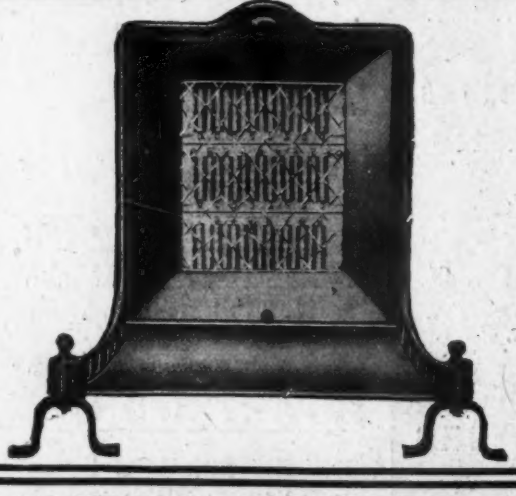

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## ELECTRICAL REVIEW.

Vol. LXXXII.] CONTENTS: March 1, 1918. [No. 2,101.

| | Page |
|---|---|
| Manufacturers and Pre-War Contracts | 193 |
| Electric Railway Results | 194 |
| Temperature Effects in Direct-Current Meters, by G. W. Stubbings | 195 |
| Problems of Industry (*concluded*) | 195 |
| Great Britain's Interest in the Metric System of Weights and Measures, by H. Allcock | 196 |
| Switchgear Standardisation, by C. C. Garrard (*illus.*) | 197 |
| Correspondence— | |
| Comparative Costs of Steam and Electric Drive | 199 |
| Electric Power Supply in Great Britain | 199 |
| The 12½ per cent. Award and Clerical Staffs | 200 |
| The Organisation of Electric Supply Officials | 200 |
| War Items | 201 |
| Legal | 201 |
| Business Notes | 202 |
| Notes | 206 |
| Reviews | 209 |
| City Notes | 210 |
| Stocks and Shares | 212 |
| Market Quotations | 212 |
| National Electricity Supply, by "A Power Station Engineer" (*concluded*) | 213 |
| A New Principle in the Flow of Heat, by C. Hering (*illus.*) | 214 |
| New Electrical Devices, Fittings and Plant (*illus.*) | 215 |
| New Patents Applied for, 1918 | 216 |
| Abstracts of Published Specifications | 216 |
| Contractors' Column | Advertisement page xxii |

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Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

**Subscription Rates.**—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

**FOREIGN AGENTS:**

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31a, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

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NEW YORK: D. Van Nostrand, 25, Park Place.

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PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1° 307.

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TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

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Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

## MANUFACTURERS AND PRE-WAR CONTRACTS.

A COMMITTEE appointed by the Board of Trade in April, 1917, to consider the position of British manufacturers and merchants in relation to contracts entered into by them before the war, has recently issued its report. In the nature of things, it was hardly to be expected that the Committee could or would prescribe a sovereign remedy for all the hardships brought about by the war, and we are not surprised to find that the report contains the following paragraph:—"We cannot too strongly emphasise our opinion that the best possible solution of the difficulties we have been considering lies in the extension of this spirit of compromise. We are confident that as it has already solved many of them, it will solve most of those that remain."

This finding might almost be regarded as axiomatic. Were litigants ready and willing to compromise their differences the Law Courts might close their doors. But alas! compromise is, and must always be, based on a recognition by each party that there is something to be said for the views of the other side, and there are those who will listen to no compromise except the full recognition of their legal rights.

To give the Committee its due it is necessary to appreciate the extraordinary difficulty of the problem it had to consider. It had to inquire into contracts between persons in the United Kingdom, and between English subjects and "persons or companies in the United Kingdom or in allied or neutral countries." If the rights of British subjects *inter se* have to be settled our legislation or our Courts may be able to do justice; but different considerations arise when one party to a contract is a Frenchman or a Swede. He will look upon the matter from a different standpoint.

Let us state quite briefly what the law was as to the performance of pre-war contracts, and then indicate to what extent it has been modified by legislation. It is not until these points are considered that the recommendation of the Committee can be adequately understood.

*Primâ facie*, if a man binds himself by contract unconditionally to do that which turns out to be impossible he will be held to his bargain, and must pay damages for his failure to perform. Where, however, the contract becomes impossible of performance, relief will be granted. But impossibility here means commercial impossibility. Mere increased cost of performance, unless to an enormous and extravagant extent, does not make it impossible. A man is not prevented from performing by economic unprofitableness unless the pecuniary burden is so great as to approximate to physical prevention.

Impossibility, for this purpose, covers the case where a man is prevented by the performance of the contract being illegal—as when it involves trading with the enemy, or an infringement of regulations made under the Defence of the Realm Act. So it has been held that a mere rise in freights at sea is no excuse for the non-performance of a contract between an English merchant and the subject of a neutral State.

This being the state of the law at the beginning of the war, it is obvious that it cannot be strictly applied without very considerable hardship. That hardship in the main falls upon the seller, and not

on the buyer. The buyer who has made a forward contract hopes to be able to sell again. If he had a contract running when the war broke out, he was able to advance his prices to the consumer. The seller, on the other hand, who stood committed to certain prices on August 4th, 1914, had no redress. The fact that relief is sought by seller rather than buyer is borne out by the fact that of the witnesses who gave evidence before the Committee, the vast majority were contractors, manufacturers, sellers, and suppliers. In only a few instances did the buyers, or consumers, or others similarly concerned come to emphasise their position—the fact being, of course, that they were, in the main, content with the present position of affairs.

The existing remedies open to a party who cannot perform his contract are as follows:—At a very early date an Act was passed which enabled the Court to stay execution on a judgment if the breach of contract which led to the judgment was due to the war. The Court in bankruptcy, too, may refuse to allow a man to be made bankrupt in a similar case. It is to be observed that this measure of relief only extended to the enforcement of remedies. It did not relieve a contractor from his obligations. Last year, however, very much wider powers were conferred upon the Courts. In July, 1917, another Act was passed under which, in the case of any pre-war contract for the construction of any building, or work, or for the supply of materials for any building or work, if the Court is satisfied that the contract cannot be enforced according to its terms without serious hardship, it may be annulled or suspended on prescribed conditions. The Court must, however, be satisfied that the non-performance was due to lack of materials or labour owing to the war, and may not make any provision for compensation to either party, nor has the Court power to frame a new contract for the parties.

It is important to notice that these powers extend only to building and works contracts. The manufacturer who is under a pre-war contract to supply machinery could not invoke these powers of the Court.

But the Act of 1917 goes somewhat further. In the case of any contract—not merely a pre-war contract—if any of its terms cannot be performed without serious hardship owing to what may be briefly termed Government interference, the Court may order its suspension or annulment. Note that this power applies to any contract made at any time. It gives relief from liability when the fulfilment of a contract has been interfered with by the action of a Government department, or of a competent naval or military authority.

While the Act of 1917 does not in either case give the Court direct power to vary a contract, it does so impliedly, because, instead of having his contract annulled altogether, the party who desires that it shall be enforced according to the letter may consent to some reasonable variation of the terms. In this sense, therefore, a considerable measure of relief has already been extended to those who are suffering from the burden of pre-war contracts.

Many of the witnesses urged that all contracting parties who have sustained loss through the advance in the cost of material and wages should be recompensed by the Government. The Committee, however, does not approve of compensation unless the loss involved is due to the direct interference of the Government. It suggests, nevertheless, that an allowance might be made—it being assessed under the principle administered by the Defence of the Realm (Losses) Commission. Subject to its pious invocation of the spirit of compromise, this is practically its only recommendation.

To a suggestion that there should be a general cancellation of contracts, the Committee replies that as many contracts of the kind under consideration were made with British subjects, the effect might prove disastrous to British credit. The only hope of adjusting differences between English manufacturers and subjects of neutral and allied countries lies in the establishment of some kind of international court of arbitration.

It is conceived that a study of the foregoing outline of the Committee's report must lead to the conclusion that the manufacturer must rely mainly upon the spirit of compromise. If the Committee has not seen its way to recommend payment of compensation for all losses out of public funds, it is unlikely that Government will undertake the burden, having regard to the present financial position of the State. For our own part, however, we cannot see why the very substantial measure of relief already granted to contractors for works and buildings should not be extended to manufacturers. It is true that, owing to daily additions to the number of articles which cannot be purchased without an "A" Certificate from the Ministry of Munitions, cases of Government interference are becoming more and more numerous. In such cases relief may possibly be obtained under the second provision of the Act of 1917. But there are numerous cases where the fulfilment of orders for machinery is being held up owing to the "diversion or insufficiency of labour" occasioned by the present war. In our opinion the law should be modified so as to give the manufacturer rights as valuable as those which are at present enjoyed by the builder and the contractor for works.

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**Electric Railway Results.**

The reports of the past year's working on the railways which are wholly or partially operated by electric traction cannot but be gratifying to those who, like ourselves, have consistently advocated the electrification of the suburban railways of this country. In spite of a vast amount of discussion, the movement has made comparatively slow progress—out of the maze of steam railways in the Metropolitan district, only some 200 miles are as yet converted to electric traction; the directors have dallied with the subject, have even admitted the probability of success, but have excused themselves from carrying out the work on the ground of uncertainty as to the best system, or other feeble objections. Nevertheless, some progress has been made, and from time to time a section of steam railway has been electrified—with the immediate result that the traffic has increased at an unexpected rate, while the expenses have remained stationary, or have been reduced. The success of the South-Western electrification, like that of the Brighton system, has been immediate and phenomenal; no fewer than 10,000,000 additional passengers have been carried during the past year, and as the chairman remarked at the annual meeting, houses in the district served are now unobtainable. The improvement in the service given can only be appreciated by those who are familiar with the conditions obtaining both before and after the change. The new service on the North-Western line to Watford has also exceeded all anticipations. Unfortunately, the war has for the present put a stop to the various developments contemplated by these companies. We hope, however, that they will proceed with their schemes at the earliest opportunity, with the confidence engendered by the success already attained on their own and other London suburban systems; the results are not in doubt—nor have they been, since the London Bridge-Victoria section of the Brighton system was electrified eight years ago. All that was wanting to emulate that success was the will to act with energy and zeal, and we hope that not only these, but also the Great Eastern and South-Eastern companies will take vigorous steps towards reform the moment they are permitted to do so.

## TEMPERATURE EFFECTS IN DIRECT-CURRENT METERS.

By G. W. STUBBINGS.

The effect of temperature on the accuracy of electricity meters is frequently treated as if it were of small importance, and the high temperature coefficient of a mercury meter is not often regarded as a disadvantage. A little consideration will show that this view is not a sound one. A temperature variation of 3° C. will cause an alteration in the accuracy of an unshunted mercury meter of about 1 per cent. To compare the performances of two such meters, the one fixed in the living room of a house, or in a cupboard leading ont of the same, and the other in the basement, the average temperature of the first in the winter months during its hours of working will be in the neighbourhood of 20° C., whilst the temperature of the other may average not more than 8° C. As the difference in temperature will be 12°, there will be 4 per cent. difference in the accuracies of the two meters. In view of the importance of this matter of the temperature coefficient of meters, a brief investigation of the magnitude of this coefficient for meters of various types, and of the factors which cause it to be modified, may not be uninteresting.

The case of an unshunted meter may first be considered. Let $\omega$ be the angular speed of the rotor, B the specific resistance of the material of the brake disk, B the braking flux; the eddy currents will be proportional to $\omega$ B/R, and the braking torque to $\omega$ B²/R, and since the driving torque is proportional to B C, C being the current in the meter—

$$\omega = \text{K C R/B, K being a constant.}$$

If $\omega_0$ and $R_0$ be the speed and resistance respectively at standard temperature, $t$ the excess temperature of working over standard, $\alpha$ the resistance temperature coefficient of the material of the brake disk—

$$\omega = (1 + \alpha t)\,\text{K C}\,R_0/\text{B} = \omega_0 (1 + \alpha t),$$

and the temperature coefficient of the meter is equal to the resistance temperature coefficient of the material of the brake disk. In the majority of mercury meters of recent manufacture the armature disk serves also for braking, and it therefore follows that as copper disks are used in such meters, the temperature coefficient of these meters will be 0·428 per cent. per degree C. The above reasoning is based on the assumption that the whole of the line current passes through the armature disk. This is not strictly true, as actually the disk is shunted by the mercury. As the resistance temperature coefficient of mercury is 0·072 per cent. per degree C., the actual temperature coefficient of the meter will, for reasons dealt with below, be only about one-third per cent. per degree C.

The second case to be considered is that of a meter shunted with a material identical with that forming the meter circuit. In this case, calling the resistance of the meter and shunt circuits respectively $r$ and $r^1$, the current in the meter will be $\text{C}\,r/(r + r_1)$, and if $r_0$ and $r_0^1$ are the values of the resistances at standard temperature, the value of this current will be, $\beta$ being the resistance temperature coefficient of the shunt and meter—

$$\text{C}\,r_0^1 (1 + \beta t)/(r_0 + r_0^1)(1 + \beta t) = \text{C}\,r_0^1/(r_0 + r_0^1).$$

The ratio of the currents in the meter and shunt circuits is therefore independent of the temperature, and the temperature coefficient of the meter accordingly is not altered by the addition of a shunt of similar metal to that of the meter circuit.

If the meter is shunted by a special resistance metal, the expression for the current in the meter circuit will now be, calling the temperature coefficient of the shunt $\delta$—

$$\text{C}\,r_0^1 (1 + \delta t)/\{r_0^1 (1 + \delta t) + r_0 (1 + \beta t)\} = \text{C}\,r^1/\{r^1 + r_0 (1 + \beta t)\},$$

since $\delta$ will usually be so small as to be negligible. The equation of torques will now be—

$$\text{C}\,r^1\,\text{B}/\{r^1 + r_0 (1 + \beta t)\} = \text{K}\,\omega\,\text{B}^2/R_0 (1 + \alpha t),$$

$$\omega = \text{K C}\,r^1\,R_0 (1 + \alpha t)/\text{B}\{r^1 + r_0 (1 + \beta t)\}$$

$$= \text{K C}\,R_0(1 + \alpha t)/\text{B}\{1 + n(1 + \beta t)\}, \text{ where } r_0 = n r^1;$$

reducing finally, approximately, to—

$$\omega = \text{K}\,R_0/\text{B} \times \text{C}/(1 + n) \times \{1 + \alpha t - \beta t\, n/(n + 1)\}$$

$$= \omega_0\{1 + t(\alpha - \beta n/(n + 1)\}.$$

The temperature coefficient is accordingly $\alpha - \beta n/(n + 1)$. The great advantage to be gained by shunting a meter with a metal of approximately zero temperature coefficient is now apparent. If the bulk of the current is in the shunt—that is, if $n$ be large—the temperature coefficient of the meter will be nearly the difference between $\alpha$ and $\beta$. This condition is usually satisfied in commutator meters. In such a meter, having an aluminium sheath for the armature coils to serve as a brake disk, the temperature coefficient of the meter will be nearly 0·43—0·42, or about 0·01 per cent. per degree C. It will be noted that the above reasoning does not take into account the back E.M.F. of the meter armature. Since the effect of this back E.M.F. is to increase the apparent resistance of the armature, and consequently to increase $n$, $\alpha - \beta$ will be a still closer approximation to the temperature coefficient of the meter.

The equation of torque for an unshunted watt-hour-meter will be, neglecting compensation for friction—

$$\text{C V}/r = \text{K B}^2\,\omega/\text{R},$$

$r$ being the resistance of the pressure coils and armature. If $\gamma$ be the average resistance temperature coefficient of this circuit—

$$\omega = \omega_0 (1 + \alpha t)/(1 + \gamma t) = \omega_0 \{1 + (\alpha - \gamma) t\},$$

the temperature coefficient of the meter accordingly being $\alpha - \gamma$.

The cases of shunted watt-hour-meters and of Aron clock meters present a greater number of variable factors. The problem of temperature effect in such meters is too complicated to be investigated profitably. It may be said, however, that in such meters the elimination of temperature effect should be more feasible than in the simpler types, owing to the greater number of available adjustments.

The high temperature coefficient is a serious defect of the small mercury meter. There seems no simple way in which it can be reduced, judging from the fact that no such device has been placed on the market. Till this problem, however, is solved, the commutator meter will retain a very important advantage over the small mercury meter, in that the temperature coefficient of the former meter can be made as small as may be desired.

## PROBLEMS OF INDUSTRY.

(*Concluded from page* 149.)

Recently Sir Herbert Austin delivered an address on Works Costs at a meeting of the Birmingham branch of the National Union of Manufacturers. According to a summary of the address appearing in the *Birmingham Daily Post*, the speaker said that post-war conditions would be much more stringent than any experienced for many years; Labour would demand a higher minimum wage, Capital would ask for a higher rate of interest, credits would be more expensive in every way, and in the big disorganisation that Peace would bring, the subject of works costs must receive serious and prompt attention. They would not have any time or opportunity to experiment, to dally with policy, or show any indecision.

To enable a manufacturer or contractor to enter confidently into an undertaking involving large sums of money, or commitments of various kinds, he must be sure of his ground, and it was here he wished to make his chief point—viz., working to a standard or predetermined cost. To firms engaged on contracting ahead for long periods or for seasons' sales, where the product was of a variable character, he counselled that the cost department should be prepared to lay down what were to be the costs and profits, before the work was commenced, or even the order accepted, and then every day to check and assure itself that the agreed or standardised costs were not exceeded. It might not be very easy in some businesses to carry out this scheme, and it would necessitate, in most cases, the provision of larger and more expensive staffs, but the confidence it gave, when properly installed, and the increased efficiency it ensured in all departments, would repay the cost a hundredfold.

The war, among other things, had brought them into a frame of mind by which they regarded combinations and associations of manufacturers in a more favourable light than before, and they

realised more fully that an inefficient, badly-managed firm or undertaking in their own line of business was a source of danger to themselves and the community at large. Therefore, it should be possible in the future for anyone requiring assistance in an organising direction to appeal to the members of his association or federation to help him, with the knowledge that he would receive sympathetic treatment.

In regard to wages, for some years before the outbreak of the war there was a great deal of agitation against payment by results, and even in cases where men were employed on piece work, or bonus systems, it was a recognised rule to hold back production to prevent anyone earning more than, say, time-and-a-quarter to time-and-a-half. Obviously, the efficiency of the shop was lowered, and the indirect result was to hold back also the work done by the day workers—in other words, a general lowering down to one agreed level of production. If they were to succeed in the effort that all serious thinkers considered imperative, then they must change this levelling down of the efforts of labour. It must be graded, and the most skilful and diligent given the opportunity to increase their productiveness. It was just as necessary to grade the labour of the country as it was to grade for military service—the best must be put at the top, and the others assisted and offered inducements to make themselves more efficient and valuable. A rising scale of rates of minimum standard pay would be required, and different piece-work prices, with an efficiency bonus for both day and piece workers who exceeded an agreed standard of output. To carry out such a change it was manifest that the works cost office might need to be strengthened to cope with the additional work, and a definite method installed of obtaining and recording proper standards of efficiency.

Speaking at the Birmingham Rotary Club on "Problems of Industrial Manufacture," Mr. Arthur Cox said that there was in reality one supreme problem—that of industrial organisation.

The complete set of problems was of colossal dimensions, but they had to be solved. Labour was getting better and better organised, and employers of labour would have to be better organised—and soon. National success depended upon the amount of harmony existing between the two organised bodies; national failure and disaster were inevitable if the two bodies were to be antagonistic. Labour wanted the assurance of a good living wage; better conditions of living; more say in the conduct of businesses; better provision for sickness and old age. The employers wanted the assurance of being able to secure a fair and reasonable return on their invested capital; the removal of all restrictions on output; full scope and recompense for initiative and enterprise. The nation would need the highest possible productive efficiency for many years following the cessation of hostilities. But to get this result there was one thing essential. The peculiar psychology of the British working man must be studied. The more the working man was really understood, the easier it would be to straighten things out. Wage payments must be based upon results in such manner as to form true profit-sharing systems which the working man could easily understand.

According to the *Birmingham Daily Post*, Mr. Cox said that the Whitley Report had sketched out a good general idea for an above-ground plan for a building proposed to be erected. The new foundation must be composed of the old granite blocks of good fellowship, but a new formula must be found for the cement which binds them together. They wanted a formula for what was a full day's work for a full day's pay. The formula for determining it must be very simple. It must take into account at all times the market value of the goods produced, and that there must be a considerable margin between cost and the selling price if provision is to be made for superannuation, and for full pay for holidays and during sickness.

Mr. J. Percy Plant said that there were difficulties when firms came to carry out the recommendations of the Whitley Report. His firm had attempted to do this, and they had found that the election of a Works Committee by ballot did not tend to produce the men who were really representative of the various sections of the works. That was an element of weakness.

The *Labour Gazette* for February contains the full statement of objects and constitution of the National Council which has been formed in the Pottery Industry, and as this is the first Whitley Council to be formed, we refer our readers to the *Gazette* for the details of the constitution. Space only permits us to publish the objects with which it has been set up, but we recommend these for consideration by the electrical and engineering industries:—

The advancement of the Pottery Industry and of all connected with it by the Association in its government of all engaged in the industry.

It will be open to the Council to take any action that falls within the scope of its general object. Its chief work will, however, fall under the following heads:—

(*a*) The consideration of means whereby all manufacturers and operatives shall be brought within their respective Associations.

(*b*) Regular consideration of wages, piece-work prices, and conditions, with a view to establishing and maintaining equitable conditions throughout the industry.

(*c*) To assist the respective Associations in the maintenance of such selling prices as will afford a reasonable remuneration to both employers and employed.

(*d*) The consideration and settlement of all disputes between different parties in the industry which it may not have been possible to settle by the existing machinery, and the establishment of machinery for dealing with disputes where adequate machinery does not exist.

(*e*) The regularisation of production and employment as a means of insuring to the workpeople the greatest possible security of earnings.

(*f*) Improvement in conditions with a view to removing all danger to health in the industry.

(*g*) The study of processes, the encouragement of research, and the full utilisation of their results.

(*h*) The provision of facilities for the full consideration and utilisation of inventions and improvements designed by workpeople and for the adequate safeguarding of the rights of the designers of such improvements.

(*i*) Education in all its branches for the industry.

(*j*) The collection of full statistics on wages, making and selling prices, and average percentages of profits on turnover, and on materials, markets, costs, &c., and the study and promotion of scientific and practical systems of costing to this end.

All statistics shall, where necessary, be verified by chartered accountants, who shall make a statutory declaration as to secrecy prior to any investigation, and no particulars of individual firms or operatives shall be disclosed to anyone.

(*k*) Inquiries into problems of the industry, and where desirable, the publication of reports.

(*l*) Representation of the needs and opinions of the industry to Government authorities, central and local, and to the community generally.

## GREAT BRITAIN'S INTEREST IN THE METRIC SYSTEM OF WEIGHTS AND MEASURES.

By HARRY ALLCOCK.

1. When the war is over it must be paid for. The burden of post-war taxation can only be lightened by increased production, and by the sale of these excess products to overseas consumers.

2. Provided always that the menace of a conflict between Capital and Labour is removed without reverting to "restriction of output," and that adequate supplies of raw materials and cheap power are assured, we shall find ourselves at the end of the war with enormously increased resources for cheap production as compared with our pre-war position. The capacity of our industries to absorb the labour of our demobilised fighting forces will thus depend mainly upon our ability to increase the demand for our goods.

3. Unfortunately, our sales organisations have necessarily been neglected during the war period, and, in addition to the fact that other countries have not failed to profit by our temporary inability to execute overseas orders, we must bear in mind that post-war economic pressure will intensify the international struggle for commercial supremacy.

4. We shall accordingly find ourselves confronted by unusually keen competition abroad at a time when the national interest demands an enormous expansion of our overseas trade. It will thus be just as necessary for us to organise our export trade as it was for us to organise, for instance, the manufacture of shells and other war munitions.

5. This necessary organisation and development of our export trade will demand the elimination of all hampering influences. In this connection it will then be remembered that for years past our overseas representatives—both Government and private—have urged the importance of our more extensive use of the international metric system of weights and measures which so many of our present and potential overseas customers already employ. (The use of the metric system is obligatory in 34 countries, representing a population of over 437 millions, and optional in a further eleven countries having a population of over 727 million people.)

6. Whether we like it or not, we already find ourselves compelled to use the metric system for a portion of our trade and to an ever-increasing extent. The retention of our own British system thus compels us to handicap ourselves by working in two systems where one would suffice. For the reassurance of those who, having no intimate knowledge of the metric system, feel some alarm at the suggested abandonment of the British system in its favour, the following statement by the Right Hon. A. J. Balfour, M.P., may be quoted. Replying to a deputation in 1895 he said:—

> "Upon the merits of the case, I think there can be no doubt whatever that the judgment of the whole civilised world, not excluding countries which still adhere to the antiquated systems under which we suffer, has long decided that the metric system is the only rational system."

7. Germany employs one system—the metric system—throughout her laboratories, workshops, home trade, and foreign trade. Britain employs the metric system in her laboratories, the British system and the metric system in her workshops, the British system for our home trade and the metric system for part of her export trade. (Our Colonies have already signified their desire to adopt the metric system simultaneously with the Mother Country.)

8. When we realise that our national existence depends upon our ability to sell British manufactured goods to all nations, *i.e.*, to develop a world-wide trade, it will be apparent that Great Britain, more than any other country, would benefit from the establishment of a universal system of weights and measures. It will be obvious

that our adoption of the metric system would establish it as the universal language of quantity, but, on the other hand, it is equally clear that the British system could never become the universal system, because of its inherent defects. In the early seventies Germany adopted what was then known as the French metric system, notwithstanding the anti-French sentiments then existing on account of the Franco-Prussian war. Since that date the use of the system has been extended to 24 additional countries, and it is now truly described as the international metric system. These facts should be borne in mind by those who may be inclined to consider that our adoption of the metric system would benefit Germany more than ourselves.

9. At the end of the war British manufacturers will not merely revert to their pre-war standard products—new designs and new methods will be the order of the day, and a unique opportunity is thus presented for the reorganisation of British firms on the metric basis. If all sales were then compulsorily made in terms of the metric system, it would follow that all new designs, patterns, &c., would be prepared on the metric basis, but the old patterns, &c., could be continued in use for manufacturing purposes until they became worn out or obsolete. In selling the products of these old British-dimensioned patterns, &c., all dimensions in tenders, invoices, &c., would be given in metric equivalents, just as we do to-day in our export departments. With the passage of time such conversions would naturally decrease in volume, and finally disappear, whereas, under existing circumstances, they must increase continuously.

10. In some cases where the coincident use of the British and metric systems during a transition period could be shown to be especially inconvenient, it would not be unreasonable for the Government to bear the cost of the change by, for instance, allowing the firms in question to retain out of the amount they would otherwise pay in excess war profits a sufficient sum to enable them to replace their present stocks of British-dimensioned patterns, &c., by new metric patterns, &c. Any costs so borne by the nation as a whole would be speedily reimbursed to the taxpayer through the medium of the reduced taxation rendered possible by the consequent expansion of our export trade and its attendant benefits.

The value of the collateral advantages accruing to the entire community from our adoption of the metric system (*e.g.*, the economies of time and labour in education, in calculations involving quantities and dimensions, in communications between the scientists, the producers, and the consumers of the world) cannot be expressed in money, but it would be admittedly very great.

It should also be remembered that the longer our adoption of this inevitable reform is deferred, the greater will be the magnitude and extent of the incidental difficulties to be overcome.

## SWITCHGEAR STANDARDISATION.

By CHARLES C. GARRARD, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

Of all departments of electrical engineering, switchgear is perhaps the one whose development is in the greatest state of flux, and in which more changes and improvements are continually taking place, and will continue to take place, than in any other. Under these circumstances, at first sight, it may be thought that it is a very unfit subject for standardisation. Such a conclusion, however, betrays a want of appreciation of the true and best meaning of standardisation. Standardisation properly understood is essentially a co-operative action on the part of the designers and manufacturers concerned in order that the best product may be produced in the shortest time, and with the least expenditure. To attain this end each party throws into the common stock his knowledge and experience; the old-fashioned secretive policy is abandoned, it being recognised that in this, as in so many other departments of national life, the purely individualistic policy must give way to the more enlightened and, in the long run, better-paying one of mutual help and combined action.

Apart, however, from the need of such a change in our methods, if we are to maintain our position in the world's engineering market in the future, it must be recognised that it is also necessary if we are even to put ourselves upon an equality with other countries. Switchgear standardisation has already had considerable attention paid to it in America, Switzerland, and Germany, and one object in view in submitting this paper is to call attention to this fact, and to urge that such steps be taken as will put an end to this unsatisfactory state of affairs.

The authority for engineering standardisation in this country is the Engineering Standards Committee. According to the 1917 report of the Committee no single standard specification dealing with any form of switchgear has been issued. In fact, there does not seem to be any suitable organisation within the Standards Committee to deal with such work. It would appear that there is urgent need for the formation of a special sub-committee to deal specifically with switch and controlling gear.

A standard test pressure should be agreed upon applicable to all switch and controlling gear. This should be higher than the corresponding test for machinery. The American Standardisation Rule No. 500 specifies for machinery a test pressure equal to 1,000 volts plus twice the normal; for switches and control apparatus above 600 volts, however, Rule No. 509 calls for 2,000 volts plus 2½ times the rated voltage. This test is very good and reasonable, and, moreover, is a sufficiently high one for any form of switchgear. We cannot do better than adopt it.

The standardisation of copper has already received considerable attention from the Engineering Standards Committee, and a similar standardisation of the other current-carrying materials used in switchgear should be made. These include brass, gun-metal, and phosphor bronze. The whole subject of copper alloys stands in urgent need of standardisation. The percentage composition of a "brass" casting is, for example, a very nebulous quantity.

A standardisation of the length of break of knife switches, distance between the centre lines of the poles, sizes of terminals, current density in the material, and general style of construction is very necessary. At the present time various authorities have fixed their own standards, necessitating special manufacture. In addition, numbers of obsolete requirements are still insisted upon in certain quarters. For example, the condition that the hinge of a knife switch should not carry current still survives. This should be obviated in future. As regards the current density of surface contacts, it is not desirable to fix limits as to this, as apparently very high surface densities sometimes yield very good

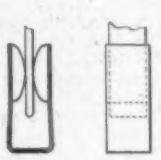

Fig. 1.—Controller-finger Type of Switch Contact.

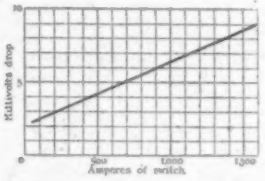


Fig. 2.—Millivolt Drop at the Jaws of Knife Switches.

results. There is much to be said in favour of the type of switch contact illustrated in fig. 1. With the ordinary form of flat contact the current really only passed at a single or a few points. With the controller-finger type, however, a definite line contact is obtained. A standardisation of the millivolt drop at contacts would be a very good thing, and, as this is a direct measurement of the capability of the device to make contact, has much to recommend it. The values given in fig. 2 are founded on actual practice in good work.

Considerable variations exist at present in the practice of different manufacturers in regard to back connection studs, more especially as regards the screw threads adopted. The type of thread used must be determined more from considerations of electrical conductivity than from mechanical ones. The Whitworth screw threads, for example, on the larger sizes have too coarse a pitch, which cuts unduly into the cross-section of the rod. A standardisation of these screw threads, as also of the corresponding nuts, is very necessary. The particulars given in Table I have been found suitable by

TABLE I.—Suggested Standards for Back Connection Studs for Switches, &c. Whitworth-Shaped Thread.

| Current in amperes. | Rod diam. in inches. | Screwing of stud. | Current in amps. | Rod diam. in inches. | Screwing of stud. |
|---|---|---|---|---|---|
| 3,000 | 2 | 11 threads per in. | 300 | ⅝ | ⅝ in. Whitworth standard. |
| 2,500 | 1¾ | " | | | |
| 2,000 | 1½ | " | 200 | ½ | ½ in. " |
| 1,800 | 1¼ | " | 150 | 7/16 | 7/16 in. " |
| 1,500 | 1⅛ | " | 100 | ⅜ | ⅜ in. " |
| 1,200 | 1⅛ | " | 75 | 5/16 | 5/16 in. " |
| 1,000 | 1 | " | 50 | ¼ | ¼ in. " |
| 800 | 1 | " | 25 | 0·184 to 0·186 | No. 2 B.A. |
| 600 | ¾ | " | | | |
| 400 | ¾ | " | | | |

the author. It will be seen that with the exception of the smallest size the Whitworth form of thread has been adhered to. In all sizes, however, about ⅝ in. diameter the pitch is smaller than that of the corresponding diameter Whitworth standard screw. Above 3,000 amperes the form of construction illustrated in fig. 3 is to be preferred. Strip connections riveted and soldered into the switch block constitute a better electrical connection and, moreover, are cheaper to construct in these sizes than studs would be.

The nuts for making the connection between the studs and the connection strips must be thinner than standard Whitworth nuts. This is necessary in the first place from considerations of space, which is naturally limited at the back of switchboards. The chief point, however, is that it must be possible to make a neat job of the multiple strip connec-

tions attached to the studs so arranged that they occupy the minimum of space consistent with efficient ventilation. The best arrangement is to make the spacing nuts double the thickness of the standard connection strip.

The nuts should be practically flat-sided, the corners only being slightly chamfered to prevent their cutting into the material of the strips.

The standardisation of oil switches is at the moment receiving attention, and will, therefore, not be discussed at great

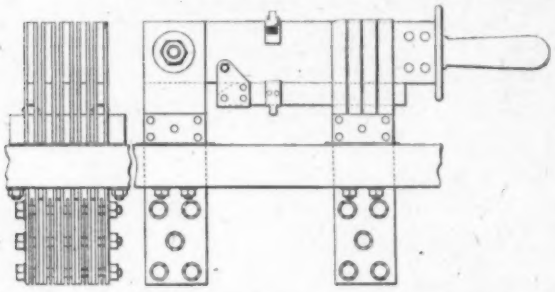

Fig. 3.—Large Knife Switch with Strip Back Connections.

length here. The considerable amount of work which has taken place in other countries has had the result, before the war, of greatly assisting our foreign competitors' export trade in switchgear. The German manufacturer, for example, fortified with a set of carefully worked-out standards, was at a great advantage as compared with the British manufacturer, who had nothing similar to put forward.

The German, or "V.D.E.," rules referred to not only include a set of standards as regards the construction of the switches themselves, but also a number of suggestions to guide the operating engineer in his selection of a suitable switch having regard to the possible value of the short-circuit current at the situation where the switch is to be used. Such a set of rules is of the utmost service.

The most important point in switch standardisation is their rating in terms of breaking capacity. Such a rating can only be reliable if based upon actual experience. Systematic tests are necessary if progress is to be made in a reasonable time. Recently, and since the war, the Allgemeine Electricitäts Gesellschaft of Berlin has built a special laboratory for the specific purpose of testing oil switches.

It is improbable that any single concern will go to the great expense of establishing and running a research laboratory on the necessary large scale. This would be much better dealt with by co-operative action between the industry as a whole and the Government. This action could take the form of the establishment of a national high-tension research and standardising laboratory, which could deal with such problems as this and those mentioned under the heading of lightning arresters. The equipment, staffing, and running of an efficient laboratory on the necessary scale mean something altogether different from anything yet attempted in this country. The very best engineering talent should be secured for its direction, and considerable financial resources would have to be available for the large-scale experiments necessary.

The leading consideration to be borne in mind when installing an oil switch on a large system is the maximum power in kilovolt-amperes which it will have to rupture. The

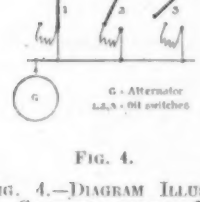


Fig. 4.

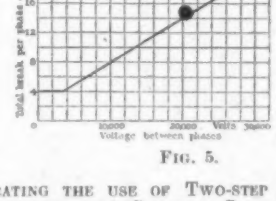


Fig. 5.

Fig. 4.—Diagram Illustrating the use of Two-step Oil Switches having Resistances, or Choking Coils, connected between the Steps.

Fig. 5.—Curve Connecting Total Length of Break and Voltage of Oil Switches.

use of reactances to limit the short-circuit current has now become recognised as essential for continuity of supply. It is suggested that a maximum breaking capacity of 500,000 K.V.A. should be regarded, at present, as the largest short-circuit load with which any oil switch should be called upon to deal. This is considerably larger than any of the standards set up by the V.D.E., and would therefore constitute a considerable advantage over those rules.

The use of the two-step oil switch (fig. 4) having a resistance or choking coil connected between the two steps has been advocated in some quarters. The Swiss Elektrotechnischer Verein recommends this. With such a switch, on switching in, the resistance is momentarily connected in series with the circuit, and then short-circuited. On switching off the order of procedure is reversed.

The use of the charging resistance is of value in the case of switching-in large transformers, for preventing the abnormal rush of current which sometimes occurs. Such a current, however, lasts only for a very short time, and the only real trouble is due to the tripping of the overload release gear. This can be guarded against by a time lag on the transformer switch. For switching-in cables such double-contact switches are totally unnecessary.

Such charging resistances are also sometimes used for switching-in large motors, the object being to prevent the concentration of voltage across the end turns of the windings and consequent danger of internal short-circuit. For this purpose a non-inductive resistance is not much good, but a charging choke coil should be used. A method such as this is simply a condonation of inferior insulation of the machine concerned. If this latter were properly constructed, such special switching appliances should not be necessary.

The Swiss Electrotechnical Society base their recommendation of the use of such double-contact switches on their alleged capability of dealing with heavier short-circuits than single-contact switches. It is very much to be doubted whether this contention is right, and in the absence of reliable test results, made under the heaviest conditions, it should not be accepted.

It is possible, by means of special constructions, to shorten considerably the length of break necessary in an oil switch.

It is better to have such a length of break that a reasonable degree of safety is secured, even if the special devices mentioned are put out of action. By length of break is meant the total length; thus if there are two breaks per phase it is the sum of the two breaks. Fig. 5 represents the average of a number of first-class modern manufacturers, and may be taken as typical of present-day designs. For switches of exceptionally large breaking capacity, however, the breaks are sometimes larger than those indicated in the curve.

In all cases, for switches of any considerable size, insulating barriers should be arranged between the phases. The question whether a separate oil tank should be used per phase is simply one of size and weight. On the larger switches a single tank becomes too unwieldy to handle. For great breaking capacities, therefore, three tanks are used, and with such switches it is better to arrange for actual concrete or brick barriers to separate the phases entirely.

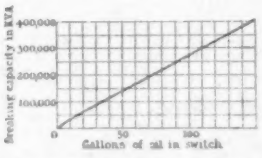


Fig. 6.—Curve Connecting Quantity of Oil and Breaking Capacity of Oil Circuit-breakers.

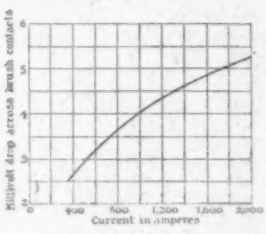


Fig. 7.—Millivolt Drop Across Brush Contacts.

As the oil is the medium for taking up the energy liberated within the switch at the instant of rupture, it is to be assumed that the more oil there is the greater the breaking capacity, provided, of course, that the whole of the oil is brought into effective use. Much larger oil tanks than were previously used are now common. The curve in fig. 6 connects the total quantity of oil and maximum K.V.A. breaking capacity, and may be taken as representing good modern practice.

A high speed of operation is now recognised as an important factor in increasing the breaking capacity. It is of the utmost importance that the current be finally ruptured during as small a proportion of the total travel as possible. It must be borne in mind that if there are two breaks per phase, the circuit is being actually opened at twice the speed of the mechanism.

In circuit breakers, brush contacts are usually used at a very considerably higher contact surface-density than the jaws of knife switches. A separate standard of specific pressure drop of brush contacts is therefore required. The values given in fig. 7 represent results which can be obtained by reasonably good work, and which do not result in temperature rises above those suggested later.

*(To be concluded.)*

## Discussion in London.

The President, Mr. C. H. Wordingham, said the author gave them many practical suggestions. There were one or two matters to which reference might be made: he was glad to see that the author recognised the Engineering Standards Committee as *the* authority on standardisation in this country. It was so, in fact, and all engineering authorities should support it. A conference had been held last year with the B.E.A.M.A. at which Mr. Hobart represented American interests, and it was agreed that H.T. switch standardisation

should be taken up with American co-operation. They were about to set up a strong committee which would deal with the matters referred to by the author in the near future. A standard specification was about to be issued for the face-plate type of motor starter, which was the most widely used. He agreed as to the necessity for investigation in switch design, but felt it would be better to use existing institutions rather than to start new ones; he was hopeful that the Standards Committee would be able to call on the Institution for help, and that the latter would induce the Local Sections to assist by sub-dividing the work amongst them. Standardisation was a thorny question; it was largely a question of reconciling conflicting interests, and it was hopeless to put forward standards which might be good for the user unless they were acceptable to the manufacturer also.

Captain A. M. Taylor said he was personally interested in oil switches, in regard to which acquaintance with one or two serious burn-outs had impressed him with the necessity for reliable construction. At Birmingham they had endeavoured to use switches suited to the maximum short-circuit current at the point of use; he quite agreed with the necessity of sectionalising bus-bars, but some diversity of opinion existed on the question. The two-step switches would be very useful under some conditions. It was misleading to consider breaking capacity in relation to head of oil over contacts, as this was unjust to some designs where the best possible use was made of the oil. The quantity of oil was a factor when a conflagration took place; in some cases many hours elapsed before the switch could be touched.

Mr. E. W. Cowan said he agreed almost wholly with the author. He suggested, however, that it would be an advantage to specify red-metal for castings in addition to brass and gunmetal. Red-metal should take the place of cast copper. Too much attention was paid to area of contact in switches, and too little to points of contact; he agreed as to the value of the millivolt method of standardising drop across switch-contacts. In oil switches, the head of oil was the important thing; he described a method of quenching the incandescent vapour arising from the break, which had been used in the Transvaal systems. He agreed that standardisation was very necessary, and the industry must assist in it.

Mr. H. H. Berry said the paper gave them excellent material for future deliberation in connection with standardisation. The primary matters were standardisation and a proving-house to prove the designs, &c. He warned them not to adopt the same method as the United States, where the manufacturers whose material was tested supplied the funds; there apparatus had been standardised to the exclusion of much simpler apparatus to do the same work. Here we must endeavour to standardise the simplest form of apparatus which could be made interchangeable; in America better apparatus was thrown out on its demerits in regard to non-interchangeability.

Mr. E. T. Williams was convinced that if they wanted to compete for business in the future, they must take up standardisation in a thorough way. The primary intention in standardisation was not in reference to replacements, but rather the avoiding of a multiplicity of articles where one or two would suffice. They must not stifle invention or new development. He knew that there was a pronounced feeling that if anything new required taking up they had to go to the Americans or, before the war, to the Germans. They must give consideration to new ideas.

Mr. Gott said they needed a clear definition of the scope of standardisation. He did not attach much importance to the author's specification for castings, as a little impurity had a great effect on conductivity. Something could be said, in the case of large switches, for clamping the switch after making contact. The smaller size threads suggested for switch connections, &c., were too small for mechanical reasons, and there were far too many sizes on the list. He agreed as to the utility of two-step switches, and had no sympathy with the interruption of large currents disruptively.

Prof. Morris agreed with the views expressed on standardisation. He suggested that certain alloys were worth considering to take the place of materials now used in switch work; rolled aluminium, for instance, should be included in the list. He agreed that contact efficiency was far more important than contact area, and suggested that in oil switches a series of oil jets issuing through perforations in the contact surfaces would be far more efficient than simple tank immersion. As copper fuses blew very much quicker than lead fuses, it was possible to grade fuses so that they would blow in the right order.

Mr. A. H. Ellis said that nothing less than ⅜ in. diameter studs should be used in switch work. It was an erroneous impression that oil-switch tanks rarely blew off; such tanks should be of boiler plate, with suitable vents, and very pure oil should be used. It was a question whether it was not better to use a multiple break rather than to increase the length of opening; he disagreed with the length of break for oil switches given by the author. A great quantity of oil was not necessary. Fuses should be tested under the worst conditions at the station; if they were safe there, they would be safe outside.

Mr. W. T. Talbot-Batbman agreed as to the need of standardising, though if it necessitated the pooling of the ideas of all makers there would be disagreement. Absolute similarity of manufacture was not necessary, as each works would require its own patterns, tools, &c. Standardisation was necessary in cases where other people's material was affected, but he could not agree that it was suited to oil switchgear. He suggested that temperature rise should be the measure of carrying capacity in switches.

Dr. Garrard briefly replied to the discussion, and the meeting closed.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Comparative Costs of Steam and Electric Drive.

A certain factory uses steam for manufacturing and driving. It is desired to compare costs for steam and electrical driving. What are the most essential points to prove which is the cheaper to run? Labour can be taken at pre-war rates, and coal at 10s. a ton. The load, 500 H.P., which is fairly compact, is working full on 10 hours a day for five days, and five hours Saturday. The Lancashire boilers are near the engine, and one is used specially for the driving. It is understood that the consumer pays for 500 yd. cable, 440-volt D.C., to couple up to Corporation mains. Three schemes can be taken:—(1) One large motor, 500 H.P.; (2) five motors, 100 H.P. each; (3) 20 motors, 30 H.P. each.

**Steam.**

### Electric Power Supply in Great Britain.

The interim report of the Coal Conservation Sub-Committee, which was released about two months ago, has so far evoked very little serious criticism, and whilst I realise that perhaps it is not advisable for the opponents of the report to be in a hurry to disclose their side of the case, yet I feel that it is time that some of the one-sided statements should be challenged, and I venture to offer the following comments in the hope that others will take up the matter, and not allow those unacquainted with the details to swallow the report as being the one and only cure for the health of our electric power supply.

One cannot help noticing at the outset that the report is dated April 16th, 1917, and the fact that it has been kept secret so long, when such vital interests were at issue, immediately raises suspicion. I have read the report several times, and fail to find anything in it that can be said to "assist the enemy"—unless such enemy be the municipalities, and the tone of the report suggests this.

Suspicion is deepened still more when we see the way in which the Board of Trade endeavoured to ignore the municipalities in the composition of the Committee it appointed to report on the Electric Supply of Great Britain.

I feel it is up to the municipalities, through the I.M.E.A., to issue a counter-report, seeing that the Coal Conservation Sub-Committee, which is without a municipal representative, has so vigorously attacked municipal ownership.

Now a few remarks on the report itself:—

A great effort is made to show a "total *possible* national advantage of £100,000,000 per annum." Note carefully the wording—a "possible national advantage." No word as to the net financial result.

The report is noteworthy in its silence as to the cost of establishing all the super-stations and trunk roads to obtain the national advantage referred to. Not a single figure is given as to the capital cost that will be involved, or the ultimate price at which one may expect to purchase the power; these and many other vital financial points are conveniently ignored.

Some enlightenment, however, is vouchsafed in Appendix D, page 26. It is there stated in regard to the North-East Coast operations, that "its development and the growth of its profit-earning capacity were considerably delayed by the work which had to be done from time to time, and the sacrifices that had to be made to secure uniformity of system." If this has been the case in one district, what will be involved for the whole of Great Britain? The location of some of the larger existing power stations is criticised, but here, again, not the slightest indication is given that suitable sites are obtainable which will embrace the three essentials, viz.:—(1) An ample supply of water, (2) close proximity to coalfields to effect saving in transport, (3) to be within reasonable distances of the districts to be supplied.

The Newcastle district is held up as a pattern for the rest of Great Britain, but, of course, no more ideal district could be found for such a scheme, and this is admitted in Appendix D, on page 26 of the Report, where it is stated that in coal, iron, and shipbuilding the North-East Coast figures represent respectively and approximately one-fifth, one-third, and half of the nation's output.

Again, the prices charged on the North-East Coast are compared with the Lancashire area. Here, of course, is the old saying that figures can be made to prove anything, and the usual misleading "average" is taken to justify the claim.

I venture to say that if the prices charged to individual

consumers on the North-East Coast be compared with those of municipalities where the consumers take equal quantities of power under similar conditions, there will not be found to be that large difference which the report suggests, particularly bearing in mind that the municipalities pay a fixed interest on their capital, and also make definite repayments of capital each year.

Great stress is laid upon the necessity of one large controlling body of private interests for the electric supply, and comparison is made with the railways, but there is this immense difference—under the proposals for the electric power supply there would be an absolute monopoly, but this has not been the case hitherto with the railways; for instance, a passenger from London to Edinburgh had the option of not less than three routes, and each company did their best to make that particular route the most attractive.

We have heard a great deal lately of the soullessness of the War Office, and one knows, to their sorrow, what Government control means in business, and many examples could be quoted of the deterioration of public services once they have become merged into one immense individually-controlled concern, such as is now proposed for the electric power supply of Great Britain—soulless is, I think, the best description.

As against these examples, let us consider the tramway systems of Great Britain. Can it be said that the Liverpool, Manchester, Leeds, Birmingham, Sheffield, and Glasgow (to quote a few) systems are examples of municipal mismanagement, and can any company-managed undertakings show better results than these? Similarly with electric power supply, it has yet to be *proved* that private ownership and management is better than a municipal one.

The fetish of super-stations, I know, is the reply, but such reply can only be accepted if backed up with definite proof that the change is going to be a sound one, not only nationally, but financially, unless, of course, the nation is prepared to pay for the advantage it will obtain in the calculated conservation of its coal supply. It is monstrous to suggest that an individual must pay more for his electricity in order to benefit the nation by conserving the coal supply.

The aspect of the question from the electric supply legislation point of view is laboured at great length, and here, again, the municipalities come under the whip. It is well known that the desire of the power companies was to traverse all districts and scoop up the large and remunerative consumers, leaving the small and unremunerative ones to the municipality, and this idea is still running in their minds, as on page 16, paragraph 40, also page 14 of the report, they suggest that the new authority take over all existing undertakings and systems, except "possibly the lighting and small power consumers."

Here in a nutshell is the answer to the insinuations made against municipalities in the second paragraph of the footnote on page 13, and indirectly hinted at in Appendix B.

It is not that they (municipalities) have under-charged power consumers and over-charged for other services. If anything, the reverse is the case, and innumerable instances could be quoted to show that the sale of power at low prices has enabled the charge for other services to be reduced. It is the small consumer that is a drag on an undertaking, unless there is a preponderance of large consumers to make the small ones a negligible quantity, and that is why the report suggests that the new authority take over the large remunerative supplies, leaving the small and unremunerative ones to local bodies.

Whilst the legislative difficulties of power companies are emphasised, nothing is said about similar difficulties that municipalities experience. They are bound to accept all consumers, large or small, and treat all alike, and they are always jealously watched by gas authorities and others to see that they do not exceed their legal powers (the recent Hackney case is a notable example).

Very few undertakings have power to hire apparatus or carry out any installation work, all extensions to the plant and mains have to receive the solemn sanction, after due inquiry, of the L.G.B., and the annual interest and repayment of loans have to be rigidly adhered to.

The municipality is bound to the four corners of its provisional order area, and any new business, although a sound commercial proposition, is out of the question if there is the slightest suggestion of preferential charges. Give the municipalities the same power as it is proposed to give to the new electric supply authority, and there is no doubt that the same saving in coal will be realised at a far less capital outlay.

It is amusing to see the pretty little fable at the foot of page 11 resuscitated in a serious Government report. Doubtless the author of it imagined himself to be the only man in London, probably the super-man. He appears to have quite overlooked the fact that the station supplying his office light *may* equally cook another man's breakfast and supply the power for a third man's train. A proposal which has to resort to such arguments for its backing must evidently be a very thin one.

It is also very pathetic to see the feeble attempt made on page 15 of the report to obtain the support of the Labour Party by dangling before their eyes the idea of a universal supply of cheap electricity. Perhaps the authors of the report could enlighten us as to how far this has been realised in all the workmen's houses in that "clean-cut example" of the North-East Coast.

In conclusion, I would say that it behoves every municipal engineer to carefully study the report, and see that *both* sides of the question are fully laid before their respective Members of Parliament, as that is the most effective method of counteracting the attempt that is being made to take advantage of war conditions to hustle the nation into handing over our electric power supply to the soullessness of company ownership, whose incentive (according to Appendix C, paragraph E) is "bigger profits," or, to put it tersely, coal conservation is mere camouflage for the creation of a huge private monopoly of our electric power supply.

**Fredk. W. Purse,**
*City Electrical Engineer.*

Carlisle, *February 22nd*, 1918.

P.S.—The above was written before the statement of the I.M.E.A. appeared. To be correct, of course, it should be "statement of the I.M.E.A. Council." The comment by the Hon. Secretary that the views set forth may not be agreeable to many of the smaller undertakings is especially noteworthy when one remembers the long struggle to obtain a more adequate representation of such undertakings on the Council. It will be interesting to watch how the opinions of the "lesser fry" will be considered and respected.—F.W.P.

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### The 12½ per cent. Award and Clerical Staffs.

The letter published by you in your issue of February 18th, from "Chief Clerk," is a timely one, as, without doubt, there exists a great diversity of opinion as to whether clerical staffs were meant to come within the scope of the award, and it is this lack of definiteness, unfortunately common to many of the orders, &c., issued by official departments, which no doubt prevents many chief engineers and electric supply committees from coming to any decision upon the matter. In some instances, however, it provides the proverbial loophole for "driving a carriage and pair through the Act," and consequently there are bound to be instances of employés being excluded who cannot enforce their claim due to this lack of clearness of definition.

It cannot but be admitted, however, that without the assistance and loyal co-operation of the commercial and clerical staffs electricity undertakings could not be efficiently worked, and it is, therefore, difficult to conceive that Sir George Askwith had the intention of excluding them from his award of January 7th. It would settle what is at present a great grievance if it were possible for Mr. Proctor, in his capacity of Secretary to the I.M.E.A., to obtain a definite official ruling upon this point for the guidance and instruction of all concerned, and would, further, ensure uniformity of treatment, which at present does not exist. Incidentally, this would also avoid the necessity for the usual stereotyped inquiry being sent round to ascertain what other undertakings were doing, and consider the saving of time and paper, &c., it would mean in not requiring to comply with the usual request for "a copy of the tabulated replies received"!

In connection with the definition of the term "technical staff" referred to in the award, may I be allowed to put the following query:—

How many clerks are there who have *not* been granted the 12½ per cent. bonus, but who *have* been claimed by their chiefs in the return on Form MM.82.S. as coming under Code Nos. 2,015 and 2,017 of the Schedule of Protected Occupations, the latter of which provides protection (above a certain age limit) for "*technical staff and clerks possessing high technical knowledge*"?

I am afraid the definition of "technical staff" is not, in many cases, the same now as in May, 1917.

**Diversity Factor.**

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I have been much interested in the correspondence in your columns from "Chief Clerk" and "Another Chief Clerk" regarding the 12½ per cent. award. I conclude these gentlemen are in a similar position to myself, and have been refused the bonus as being in a class who are not covered by the award.

It seems to me to be hopeless to await some voluntary official ruling on this point, and even if there is a remote possibility of such an occurrence, is there not some department or power to which we could independently refer our cases, and ask for a decision? Perhaps you can enlighten us on this matter.

**Inquirer.**

[As we have already indicated, the proper course, when a difference *has arisen* regarding the applicability of the award, is to appeal to the Chief Commissioner.—Eds. Elec. Rev.]

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### The Organisation of Electric Supply Officials.

The correspondence and other columns of the electrical papers show that organisation is in the air, but I have not seen any public suggestion of the need of an Association comprising officials on the commercial side of the electric supply industry.

Such a proposal is, however, bound to come, and I venture

to submit for discussion the question whether it is more to the advantage of all concerned that separate associations should be formed for different classes of officials, or that all should combine in one organisation for mutual protection and the advancement of the industry.

There is, I think, some danger of jealousy and hostility being created between different classes of officials by the setting up of exclusive organisations, and such a state of things is not likely to redound to the advantage of the individuals, or the efficient working of the undertakings concerned. The expected developments in national electricity supply may give rise to many questions involving the interests of both engineering and commercial staffs of existing undertakings, and each class could bring to a combined organisation some help in defending those legitimate interests. But I do not propose to argue the question at this stage. My object is to arouse discussion by others.

G.

*February 20th*, 1918.

## WAR ITEMS.

**Exports to China.**—The *London Gazette* for February 26th contains names of further persons and bodies in China to whom exports may be consigned.

**A German Industrial Council.**—The Amsterdam correspondent of the *Morning Post* quotes the *Lokalanzeiger* to the effect that a German Industrial Council has been founded in Berlin consisting of 25 representatives of the Union of Manufacturers, 25 representatives of the Central Association of German Manufacturers, and four representatives of the Association for the Protection of the Interests of the Chemical Industry.

**Raw Material Stocks for Peace Manufacturing.**—Dr. Addison has appointed a Committee to consider an important question affecting after-war industry. It is entitled "The Committee on Financial Risks Attaching to the Holding of Trading Stocks," and consists of representatives of Government Departments, banking, merchants and manufacturers, Trade Unions, and others. Its duty is thus described :—

"To inquire and to report as to any measures which could be adopted with a view to securing that manufacturers should be financially in a position to hold stocks after the war, and that reasonable safeguards are established to prevent serious financial losses as a result of possible depression following on a period of great inflation in respect of stocks of materials required for industry."

It is understood that as the prices of materials are greatly inflated at present, manufacturers are disinclined to purchase stocks in readiness for the resumption of full peace-time production, as they are in fear of a big fall when Peace comes, and they will be involved in loss. Dr. Addison has been informed that they are limiting themselves to quantities which will barely tide them over contracts to which they are already committed, and deferring the purchase of materials for making articles for stocks. The Committee is appointed because the above action will probably retard the return to maximum national productiveness, and it will investigate the matter with a view to devising a way out of the difficulty. Any body or association of important trade interests which wishes to have an opportunity of presenting its views on the subject should communicate with the secretary, Mr. R. C. Smallwood, Ministry of Reconstruction, 2, Queen Anne's Gate Buildings, S.W.

**The Reconstruction Advisory Council.**—Dr. Addison has now announced the names of the members of the Advisory Council which will assist him in considering the proposals that his Department has to handle. There will be four separate sections :—(1) Finance, Transport, and Common Services ; (2) Production and Commercial Organisation : (3) Labour and Industrial Organisation ; (4) Social Development (including rural reconstruction). Included in the list are the following :—Sir Henry Birchenough, Sir C. Fielding, Major-General Sir Percy Girouard, Sir R. T. Glazebrook, Mr. W. L. Hichens, Sir Clarendon Hyde, Sir C. Metcalfe, Sir H. B. Rowell, Sir H. Babington Smith, Sir Rowan Thomson, and the various representatives of labour, social, shipping, agricultural, and other interests.

**Germany and Raw Materials.**—In the course of an article in the *Frankfurter Zeitung* (quoted in the *Times*) the following paragraphs appear :—

"As regards raw materials, our aim will be to make ourselves more independent than we were before of foreign countries. It is assumed that our home production of fibres will provide a substitute for a considerable part of the cotton imports, and in copper we have been able to a large extent to make ourselves independent of foreign countries by our splendid technical achievements.

"Not the least important question to which the Imperial Office for Economics will have to give its attention is the question of the demobilisation of the workmen, which involves the greatest difficulties."

**Discharged Soldiers as Tram Drivers.**—At the Oldham Local Tribunal, a Corporation tramcar driver (33), married, B 1, was appealed for by the tramway department. The manager was asked why the Corporation supported this man's claim and not those of the other car drivers who had been before the Tribunal during the afternoon. Mr. Priestley replied that there were reasons, but it would not do to go into them in detail. He added that the department was likely to be in some difficulty in the matter of engaging discharged soldiers, as (since the recent accident at Dover, when a number of persons were killed through the act of a driver who was a discharged soldier) the Board of Trade had strongly advised against such men being entrusted with tramcar driving unless they passed a very strict medical examination. The Tribunal granted temporary exemption to July 1st.

**Exemption Applications.**—At the West Riding Appeals Tribunal, a Harrogate electrical engineer, who had been ordered to get work of national importance and recommended to substitute an engineer at the Furness Hospital at Harrogate, reported that he had not been given the job, as they said he had not enough experience to do all that was required. He was required to do general electrical work, repairs to gas stoves and cookers, to lead pipes and hydraulic lifts, splicing wire ropes, repair and refix fall pipes, repair steam pipes and taps, fix new pipes, mend locks, make keys, grind and set scissors, repair laundry machinery, repair steam engines and make new parts, &c. The National Service Representative agreed that they would never find a substitute to do all that. Exemption was granted to April 21st, conditional on finding work of national importance.

At Wolverhampton, four appeals were made by the Corporation Tramway Department, and the Chairman (Mr. L. B. Moreton) said that he was inclined to believe that two of the men were engaged in work covered by the certified list of occupations. Ald. Craddock said that protection was only given electricians at electrical generating stations. The peculiarities of the municipal tramway system, however, rendered the employment of men similarly skilled indispensable to the carrying on of the undertaking. The decisions were as under :—Battery attendant, six months ; motor man and an electrical fitter, conditional upon their employment ; motor-'bus driver, to join up within a month.

At Nuneaton, exemption was claimed by F. M. Howard (33, B 2), electrician at the Newdegate Colliery. He said that he had a colliery exemption card dated March 16th, and he had had no notification of its withdrawal beyond the calling-up papers. He was still engaged on the same work as when the card was issued. He was advised to return the calling-up papers, stating that he held an exemption card, and the appeal was respited pending the result of this.

High Wycombe Tribunal has granted six months' exemption to E. H. Milner (40, C 1) electrical engineer.

At Mansfield, an appeal was made by Geo. Cooper (35, Grade 2), electrician, who said that his business was now on the exemption list, he having contracts with the military and other important bodies. He was given conditional exemption so long as his occupation is a certified one.

Coventry Tribunal has granted six months' further exemption to R. N. James (31, Grade 3), tramway inspector, formerly in Class B 1.

At Kendal, the Corporation electricity department opposed a military appeal against exemption held by a stoker (41). The appeal was allowed, and temporary exemption until July 15th was substituted.

Hitchin Rural Tribunal has granted four months' exemption to A. Edwards (C 3), electrician, appealed for by Mrs. Sowerby, Offley.

At Barnstaple, the Military appealed against Frank Bickford (Grade 3) and Geo. W. Branch (31, Grade 3), electrical engineers. Each was granted six months' exemption.

At Brierley Hill, Messrs. Holmes & Cartwright appealed for an electrical engineer (28, C 2), and stated that bakers were now arranging for machinery in which to mix potatoes with flour for bread baking, and the man's services were required in installing the necessary plant. He was the only man the firm had left, and his time was almost fully occupied on electrical work at numerous controlled establishments. Three months conceded.

## LEGAL.

### Detention of Cables.

In an action, at Dublin, by Messrs. Farrell, timber and iron merchants, Youghal, against a Rathfarnham merchant, for the recovery of about two miles of electrical aerial cables and damages for their detention, the jury found for the plaintiffs, and fixed the value of the wires at £40 and damages for detention at 1s. It appeared that the wires had originally been used in connection with an installation at Rathfarnham. They were purchased by the plaintiffs for use on a lighting scheme for Youghal for £1,200 from Messrs. Baily & Gibson.

The Lord Chief Justice said the action had clearly arisen as the result of a misunderstanding between the parties, both plaintiffs and defendant having acted perfectly *bonâ fide*. The former believed the purchase of the aerial wire by them was complete, whilst the defendant held that he never intended to sell at the sum mentioned.—*Irish Independent*.

### Hammond Bros. & Champness, Ltd., v. Floyd.

Mr. Justice Bailhache, sitting without a jury in the King's Bench Division, on Friday, February 25th, heard an action brought by plaintiffs, electric lift engineers, of Old Kent Road, S.E., to recover damages from Mrs. A. Floyd for alleged breach of contract

in respect of the construction of an electric lift at her house in Mayfair. Defendant denied liability, pleading that it was part of the contract that the lift should be placed in the house within two months of the completion of the arrangements, and plaintiffs had failed to do this.

Plaintiffs' case was that in September, 1915, they agreed, at defendant's request, to erect an electrically-worked lift at 30, Norfolk Street, in accordance with specifications submitted, for a sum of £270 and 7s. 6d. per yard for main cables. Defendant, it was said, by a post-card dated December 2nd, 1915, refused to go on with the contract, alleging that plaintiffs had delayed the work. It appeared that an earlier contract was entered into between the parties under which the plaintiffs were to erect the lift with a D.C. supply, but the Metropolitan Electric Supply Co. could not give the continuous current, and the fresh arrangement was made on September 24th, the lift to be worked from an alternating supply. There was some delay in the passing of the plans by the L.C.C. and the necessary building alterations to the premises for the erection of the lift, but the plaintiffs had already prepared to get the material and were ready to complete the construction when the defendant cancelled the contract. They were, however, able to sell the motor and part of the plant they had prepared for the contract, for which they were willing to give the lady credit.

His Lordship, after hearing the evidence of the plaintiffs' witnesses, came to the conclusion that there had been a breach of the contract on the part of the defendant, and gave judgment for plaintiffs for £104, with costs.

## BUSINESS NOTES.

**Expert Commissioners for the Overseas Markets.**—We quote the following extracts from an article on "Investigation of Overseas Markets," appearing in the *Board of Trade Journal* :—

"The Board of Trade have frequently in the past dispatched special Commissioners to examine particular markets. Such missions have been sent to South and Central America, Canada, Australia, South Africa, Persia, China and Russia. In these cases the Commissioner has been charged with the duty of reporting on the prospects of British trade as a whole, but the growing intensity of the competition between manufacturers of various classes of commodities for the trade of the large consuming markets has made it increasingly desirable that a market should be surveyed in respect of any particular industry by men with specialised knowledge. Indeed, the principle is one which has been acted upon by the United States for some time past. Developments accordingly have recently been made on these lines. During last year three technical investigators have been sent to Spain charged with making inquiries with respect to limited ranges of goods. Thus one investigator confined his activities to the electrical trades, another to the marine engineering trade, whilst the third was called upon to cover the iron, steel and engineering trades. These technical investigations of the Spanish market resulted from an appreciation of the fact that an effective investigation of the engineering possibilities of Spain must be undertaken by an engineer, and there seems little doubt that the nature of the reports sent home has fully justified the departure.

"H.M. Trade Commissioners and Commercial Attachés in various countries overseas have recently urged with some frequency the necessity of British traders sending expert investigators in their trades to examine markets abroad. It was urged that, in order to make these investigations effective, it was desirable that the investigator should be selected by the trades concerned, and that steps should be taken to give the investigator an official position, so as to provide that official backing which was used so effectively by the German Intelligence system.

"In the early part of last year the matter was considered by a Sub-Committee of the late Advisory Committee to the Board of Trade on Commercial Intelligence, who were required to report in what industries it would be desirable that efforts should be made to induce manufacturers to combine or federate for the promotion of their joint interests in relation to their export trade, especially for the appointment of travelling investigators in overseas markets, and on the nature of the assistance which the Board of Trade could render in facilitating such combinations. The Sub-Committee took evidence from a number of trades. 'As a result of the Sub-Committee's investigations, they recommended that the Board of Trade should actively take up the question of facilitating the formation of export associations of manufacturers by placing before representative meetings of manufacturers in such trades the advantages of co-operation for export purposes; by offering to defray part of the cost of the dispatch by such associations of expert investigators to approved overseas markets; and by appointing officers to attend the meetings of the Executive Committees of such export associations in an advisory capacity, when desired. The Sub-Committee considered that the Board should contribute to the expense of the investigations, and that the reports of the investigators should be supplied immediately to members of the associations, and should only be available to the trade generally through the Board of Trade after a lapse of a considerable interval, say, 12 months.

"By the system recommended it is possible to obtain for each trade, at a comparatively small expense to the Government, the advantages which accrue from expert official investigation of overseas markets. The Board of Trade accepted the report, and appointed a Committee, consisting of Sir Henry Birchenough, K.C.M.G., and Mr. Stanley Machin, who are charged with the duty of carrying the recommendations of the Sub-Committee into effect."

**Russian Trade.**—The January number of *Russia* (6d.) contains a number of interesting articles that should be of interest to all in this country who have been looking to the vast Russian markets with hope during the past three years. The leading article on "1918 and After" deals with the position of the Bolshevist "Government" and analyses the factors making for its coming downfall.

**Bankruptcy Proceedings.**—*Re* S. S. Coster & Co. (Samuel Stephen Coster, trading as), electrical and mechanical engineers, 14, Gladstone Road, West Ham Park.—The affairs of this debtor came before Mr. Registrar Hope, at the London Bankruptcy Court, on February 20th, in relation to his public examination. He commenced business in August, 1908, and traded till November, 1916, when his stock-in-trade and effects were seized by the Sheriff. A receiving order was made against him last March, under which accounts were lodged showing liabilities £670 and assets "bad book debts, £490." The Senior Official Receiver (Mr. E. Leadham Hough) reported that on December 5th last the debtor was ordered by the Court to lodge cash and goods accounts. The public examination had been adjourned on no fewer than five occasions, but the debtor had not made any attempt to comply with the order of the Court. Under these circumstances, he asked for the public examination to be adjourned *sine die*. In the absence of the debtor, his Honour made an order in those terms.

**Catalogues and Lists.**—Messrs. Jensen & Nicholson, Ltd., Goswell Works, Stratford, London, E.—New publication giving particulars, preceded by the firm's Roll of Honour, of their electrical varnishes, enamels, &c. These insulating varnishes and compounds will henceforth be graded and classified under registered names, viz., "Lacwatt," "Coilac," "Corlac," "Miclac," and "Mafinel." The goods are of entirely British manufacture.

The Davis Furnace Co., the Diamond Foundry, Luton.—Pamphlet describing their demonstration plant at Luton, and illustrating the various patterns of the Davis patent burners for furnaces fired with gas or oil, as well as Davis crucible furnace installations, natural and induced draught furnaces, &c., for industrial purposes.

**Italy.**—The Ilva Co., one of the largest industrial concerns in Italy, is seeking to increase its capital from £2,000,000 to £6,000,000. This firm has a working arrangement whereby it directs the operations of six other Italian metallurgical and engineering concerns, thus securing uniformity in output. The object of the firm in seeking this increase of capital is primarily to carry out a programme which will, as far as possible, render Italy independent of foreign supplies. It is intended to develop the scanty fuel resources of the country, and to introduce electric power for the production of steel. A subsidiary company has been formed for supplying the Ilva Co. with the necessary power, and the surplus power will be used for developing electric traction in the South of Italy.

There has been formed the Società Anonima Industria Lampade Elettriche, at Milan, with a capital of 600,000 lire.

The Officine Italiane Costruzioni Elettriche Roseio, Fratelli Partengo e Ca. has been converted into a limited company under the style of Officine Italiane Costruzioni Elettriche, with a capital of 100,000 lire and operating at Milan.

There has also been formed at Milan the Società Anonima Elettrotecnica A. Fantini, for the manufacture and sale of electrical apparatus, with a capital of 300,000 lire.

The Società Elettrificazione Ferrovie del Mezzogiorno, Roma, is a company formed at Rome with the object of planning, carrying out, and working generating plants, transmitting and distributing electrical energy for every use, but more particularly for electric railway traction. Capital, 100,000 lire.

La Motomeccanica Società Anonima has been constituted at Milan for the construction of industrial motors and agricultural machinery. Capital, 100,000 lire.

There has been established at Sampierdarena the Società Anonima "Fatus" Fornitura Articoli Tecnici Utensili, having for scope the representation and sale of technical articles, tools, machinery, and industrial accessories generally. Capital, 75,000 lire.

**Book Notices.**—*The Great Debenture, or the Passing of National Unrest.* By Cecil Walton, O.B.E. Glasgow: Maclure, Macdonald & Co. 1s. 3d.—The author, who is the general manager of the Beardmore National Projectile Factories at Glasgow, in trying to penetrate the veil which covers the approaching years, attaches a good deal of importance to the unity to be expected from the bearing of common sorrow, and he believes that the problem of combining Capital and Labour can be solved by means of what he terms the "human touch," which will prevent those little causes of discontent which so often in the past have eventuated in a quite unjustified strike. He believes in payment by results—a system in which every worker in a factory receives his percentage on output in proportion to his basic rate. "Cheap labour does not produce cheap goods." "High wages, coupled with high horse-power, is the greatest incentive to cheap production." If the workman be allowed to get the impression that he is being sweated to make profit for another, he will adopt practices which will ensure that that profit is not earned, and the whole nation will

suffer. Mr. Walton, in urging the necessity for improved conditions in factory life and showing that the best labour may be expected to migrate to works where such are in vogue is optimistic enough to suggest that "the whole industrial population and the employer are in a state of fusion, ready for solidification." We profoundly hope that he is not wrong, but we must remember that we are under war conditions, with the enemy still at the gate, and with the State as the employer of practically all of us. When the enemy falls back, and State control with the advantages that it has brought to the worker is withdrawn, fusion will be more than ever necessary. It is upon the question how to secure that fusion then that we are all exercising our minds to-day. Mr. Walton finds occupiers of the seat of the scornful scoffing at the idea of the "human touch" in industry, and to these he replies that the sooner we realise that ideals are things to be sought for and not imbecilities to be laughed at, the better for the nation and for the world at large. He proceeds to show how "reconciliation" between employer and employed may be brought about. However well-meaning Parliament may be, Parliament, in his opinion, cannot do this. Those experienced in the problems involved on both sides must themselves move toward each other, and the State could come in to give effect to whatever arrangements they entered into. Want of space prevents our referring to the author's remarks on the skilled man, systems of payment, piecework, hours of labour, unemployment, State control, uncontrolled competition, and so forth, or to a contribution by Mr. J. C. Macfarlane on "National Efficiency," in the course of which reference is made to the "All-Electric Scheme" and various other matters; but those who are making a study of the floods of literature on such subjects that are almost overwhelming us to-day will find the "Great Debenture" a pamphlet worthy of their attention. The object of the author, as we understand it, is to raise discussion on what, next to the war itself, is our greatest problem and duty of the days to come, and to point ways to the making of a programme. He wants everyone down to the lowest grade to be interested in production and to receive payment for all that they produce above a normal output under a wages scheme. This will give increased output, shorten hours of labour, and give every worker an object in life. The capitalist should lend his property to a co-ordinating body elected because of its special fitness, under a guaranteed rate of interest.

"Typical Cases of the Deterioration of Muntz Metal (60 : 40 Brass) by Selective Corrosion." Technologic Paper No. 103 of the Bureau of Standards. Washington : Bureau of Standards. Price 10 cents.—This paper reports the study of selective corrosion of Muntz metal, tubings, sheets, and forgings. The condition favourable to such corrosion is the accelerating effect of the closely adhering deposits of chloride resulting from the attack of the metal. Other conditions accelerate the corrosion, such as contact with the more electronegative constituents, increase of temperature, and service stresses. Those interested may obtain a copy by addressing a request to the Bureau.

"A Method for Testing Current Transformers." Bureau of Standards (Scientific Paper No. 309). Washington, U.S.A. : The Bureau.—A general method is outlined in this paper for the determination of the ratio and phase angle of current transformers in terms of the constants of previously calibrated standard transformers of the same nominal ratio. It has been shown that such methods are essentially more sensitive, or, conversely, may be used with much less sensitive instruments, than the laboratory methods now in use. Two of the most convenient of the many possible modifications of the general method are described in detail. Those interested may obtain a copy by addressing a request to the Bureau.

"Glover's Vade Mecum, 1918." Manchester : W. T. Glover and Co., Ltd. Price 12s. 6d.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII. No. 1. January, 1918. New York : The Institute. Price $1.

The *Revue Générale de l'Electricité* announces the establishment of a new journal, the *Journal de la Houille Blanche*, dealing with all matters connected with hydro-electric power, including its industrial applications.

**Dissolutions and Liquidations.**—Brown & Co., joiners and general wood workers, Waterloo Sawmills, Glasgow.—Mr. G. Miller retired from the firm last September. Mr. W. Jeffrey is continuing the business under the same name, and will attend to debts, &c.

Rotherham Electrical Engineering Co., Ltd., Rotherham.—First meetings of creditors and contributories March 1st at Sheffield.

**Patent Application.**—Application has been made by Jens Orten Boving for the restoration of his patent No. 11,411 of 1910 for "An improved method of and apparatus for compressing air or other gases."

**Fire.**—An outbreak of fire recently occurred at the workshops of Messrs. Park Bros., Ltd., electrical engineers, Ealing.

**Grinding Allowance Chart.**—Messrs. Alfred Herbert, Ltd., of Coventry, have sent us a copy of a chart which they have just issued, showing the allowances that should be made on turned or bored work which is to be finished to size by grinding, in order to avoid waste of time and labour. The chart covers work up to 12 in. in diameter and of various lengths. A copy of it will be sent by the firm post free to anyone interested.

## LIGHTING AND POWER NOTES.

**Aberystwyth.**—E.L. Scheme.—Mr. A. J. Hodgkinson-Carrington has offered to the T.C. a perpetual lease of the water rights and land for £250 a year for the proposed Rheidol hydro-electric lighting and power scheme, and to make surveys and supply plans and sections of the ground for 100 guineas. The matter has been referred to the Public Works Committee.

**Barnes.**—The Special Committee appointed to consider the report of the L.C.C. Committee as to the establishment of a central authority, to be known as the Greater London Electricity Board, has recommended the District Council not to agree to the proposition, and to withdraw from the Conference of Local Authorities Owning Electricity Undertakings. The recommendation has been agreed to by the Council.

**Blackpool.**—During January 651,242 units were generated at the Corporation electricity works, an increase of 43,880 on the corresponding month of last year. The total for the past 10 months was 4,872,184 units, an increase of 449,836 on the previous similar period.

**Brighton.**—Loan Application.—The borough electrical engineer (Mr. J. Christie) has been in negotiation with the proprietors of a new diamond-cutting factory for a supply of power estimated at 800 H.P.; the cost is estimated at £10,000 for mains, plant, &c. Application is to be made to the L.G.B. for sanction to a loan.

An experimental modified form of street lighting arranged by the borough electrical engineer, with the consent of the Chief Constable, is to be extended to the principal central traffic routes of the town.

The Council has approved of the grant of a 12½ per cent. bonus to the employés of the electricity undertaking, provided that the resolution shall not apply to employés in receipt of more than £250 per annum or to women or to male employés under 21.

**Bury.**—There is a profit of £2,668 on the electricity undertaking for the past year.

**Coventry.**—Loan Application.—The City Council has decided to apply to the L.G.B. for sanction to a loan of £25,000 for extension of mains.

**Falkirk.**—Price Increase.—The following new charges have been imposed by the T.C. :—Large power (over 20 H.P. installed), £4 per H.P. of demand and 1¼d. per unit; small power (up to 20 H.P. installed) maximum demand, 4½d. per unit for first hour of maximum demand and 3d. per unit for remainder; small power (flat rate), 4½d. per unit; lighting, 6d. per unit; outside lighting, 5½d. per unit; theatre lighting, 5½d. per unit; theatre power, 4½d. per unit.

**Farnworth.**—The directors of the Suez Doubling Mill, Worsley Road, have decided to install an up-to-date electrical installation, and Mr. Hutchinson, electrical engineer to the Farnworth U.D.C., has been engaged as adviser.

**Glasgow.**—Linking-up.—The Electricity Committee has received a letter from the Ministry of Munitions regarding the application of the Electricity Department and the Clyde Valley Electrical Power Co. for authority to put down additional generating plant at their respective works, and indicating the desirability of (1) interlinking the two electric supply systems; and (2) setting up a Joint Committee or board, consisting of an equal representation of the Corporation and the Clyde Valley Electrical Power Co., for the purpose of considering with the Ministry of Munitions what is the best policy to adopt for an extension of plant for the industrial area served by both undertakings. The Committee, after considering the letter, agreed to recommend that it be remitted to a special Sub-Committee for the purpose of considering the proposals, and, if so advised, conferring with the Ministry of Munitions thereanent.

Permission has been granted by the B. of T. to the department temporarily to discontinue the supply of energy to certain consumers.

Loan Application.—The town clerk is to make application to the Secretary for Scotland for authority to borrow £750,000, which, with the present unexhausted borrowing powers, will meet the requirements of the electricity department for the next 12 months. This recommendation was come to after consideration of a report by the engineer, from which it appeared that the total borrowing powers were £3,321,478, and that £3,156,054 had been borrowed to date. It was explained that the position was (1) amount required for Dalmarnock station and connections : (*a*) contracts in operation, £593,000; (*b*) contracts for turbo-alternators, switchgear, batteries, and brick and masonry work of boiler, turbine, and switch houses, £248,000—£841,000; (2) amount required for general expenditure during year, £150,000; making a total of £991,000; less balance of borrowing powers noted above, £165,424—£825,576; and less depreciation for the year 1917-18, £60,000—£765,576.

**Huddersfield.**—Year's Working.—The income of the electricity department for 1917 amounted to £87,588, an increase of £8,079 over that of the previous year. The expenditure was £63,959, an increase of £9,093, leaving a gross surplus of £23,637 as compared with £24,651. After paying £11,326 for interest and £9,213 for redemption of capital, £2,250 is being allocated towards the relief of the rates, and the balance of £847 is being placed to the depreciation fund.

**Linking-up Schemes.**—A conference of the heads of the Lancashire and Cheshire electricity supply systems, and the Mayors of various towns in the two counties, was held in the Manchester Town Hall on Friday last. Sir Guy Calthrop, the Controller of Mines, spoke on the necessity for a further conservation of coal supplies in electricity and other municipal undertakings, and a discussion also took place on the scheme for the interconnection of the electricity supply systems in Lancashire and Cheshire. To carry out the scheme, some 62½ miles of mains will have to be laid to interconnect the various undertakings, and the estimated expenditure is £281,397.

The Rotherham Council has approved the proposal of the Joint Sub-Committee of Sheffield and Rotherham to obtain a report from Sir John Snell and Mr. Charles Merz as to the best method of providing a supply of electrical energy to Sheffield and Rotherham and the surrounding district, including the supply of electricity to the South Yorkshire coalowners, and that the representatives of the Rotherham Corporation be given authority to complete the arrangements for carrying this out.

**London.**—Stepney.—Price Increase.—The Electricity Committee recommends that the practice of charging lighting consumers in the summer months at the higher rate for two-thirds of the average March quarter's demand be discontinued, and that the summer months' accounts, in accordance with previous practice, be based upon the full average of such demand; and that the charge of ½d. per unit (subject to the advance of 50 per cent. now in operation) to consumers guaranteeing from £60 to £200 per half-year in respect of energy supplied under Scales D, E, and F be increased to ¾d. per unit.

Fulham.—Price Increase.—The Electricity Committee recommends increasing the charges for private lighting to 6d. a unit and for power and heating to 1¾d. per unit.

Hackney.—Loan Sanction.—The Finance Committee has been in communication with the L.C.C. with regard to the sanction to the borrowing of £40,000 and £28,000 for machinery and boilers for the electricity undertaking. The L.C.C. considers that the repayment of the loans which the B.C. raised at the commencement of the electricity undertaking on a 42 years' basis should be expedited, as the average unexpired period is 25½ years, and suggests that the period should be reduced by one half.

The Finance Committee reports that the change will increase the loan charges by approximately £2,000 per annum, and recommends the B.C. to agree to the conditions.

**Power Bills.**—The Newport and Cannock U.D.C.'s and the Shifnal R.D.C. have decided to lodge petitions against the Worcestershire, Shropshire, and Staffordshire Electric Power Bill.

The Saddleworth Council has decided to oppose the Yorkshire Electric Power Co.'s Bill.

**Rochdale.**—A remarkable wages application was made to the Electricity Committee last week. The grant of 12½ per cent. bonus to electricity workers was made retrospective from the beginning of October; several men who had left the service of the department in the interval applied for the 12½ per cent. from that date until the time when they left to enter other employment, but the Committee declined to grant the request.

**Spenborough.** — Price Increase. — The D.C., last week, decided to increase the charges for electricity as from April 1st by 50 per cent. to special-rate power consumers; by a halfpenny per unit, and the addition of 10 per cent. to the net amount of the account of flat-rate power and ordinary lighting consumers; and by a halfpenny per unit up to the minimum of demand and a farthing per unit above the minimum, plus 10 per cent. on the net amount of accounts, for "H.P." consumers. The estimated loss for the nine months ended December 31st last was stated to be £1,262, and the estimated product of the increased charges for one year is £2,306.

**Swinton and Pendlebury.**—The U.D.C. has referred to the clerk and electrical engineer an application from the Lancashire Electric Power Co. for permission to supply electricity direct to the works of Messrs. Gerrard & Sons.

**Tynemouth.**—The annual report of Mr. C. Turnbull, the borough electrical engineer, for the year ended March 31st last, shows that 4,609,409 units were sold, as compared with 4,528,958 in the previous year, the three-phase supply accounting for 2,690,370 units. The total revenue amounted to £22,435, and after meeting all charges, there remains a deficit of £126, as compared with a deficit of £513 in the previous year. In his report, Mr. Turnbull states that in spite of war conditions the charges for electricity have not been increased in any way, and that the small deficits since the war began have been met from profits in hand, leaving a balance of £1,185 to meet future contingencies.

## TRAMWAY AND RAILWAY NOTES.

**B. of T. Tramway Conferences.**—A conference of representatives of municipally and privately-owned Scottish tramway undertakings was held in Glasgow recently for the purpose of discussing the adjustment of the working of the concerns to meet national needs. Mr. Devonshire, chairman of the B. of T. Tramway Committee, who presided, indicated that among questions which he expected would be dealt with were the increase of fares, through the abolition of the halfpenny fare, rates for conveyance of parcels and goods, the labour problem, the better utilisation of tramcars in the distribution of food, and the transference of material and equipment. To form an Advisory Committee he suggested the appointment of one member, perhaps the manager, of each tramway concern. In the course of a general discussion it appeared that the replacement of male drivers by women had been satisfactory, Paisley being the only case in which women drivers were said to be non-successful.

Mr. Fell, L.C.C. Tramways, stated that whenever a question of policy was raised, such as the suggested closing of a route or portion of a route, and the subsequent lifting of rails for transference to other sections, a local inquiry would first be held, and the opinion of the local Tramway Committee or concern invited. It was agreed to appoint an Advisory Committee consisting of one representative from each concern, with Major Coutts (Paisley) as honorary secretary. In a concluding statement, Mr. Dalrymple (Glasgow) said matters would have to be very serious before they took the extreme step of closing an undertaking. At the same time, some of them might have to close particular routes, or parts of routes, and possibly might have to lift the rails on those routes. In the central part of Glasgow the track was getting into a very bad condition.

An important conference of Lancashire and Cheshire tramway authorities was held at Liverpool Town Hall, on Thursday last week, relative to the establishment of an Advisory Committee for the area. Representatives of 32 municipal and company owners of tramways were present, with representatives of Corporations which are lessors of tramway tracks. The Lancashire and Cheshire area is one of the smallest of the eight into which Great Britain has been divided in connection with the scheme of tramway control, but it is also one of the most important.

Mr. James Devonshire, chairman of the Board of Trade Committee, presided, and pointed out that the Board of Trade did not wish to control tramway undertakings, but rather to relieve them of as many of their difficulties as possible. The area, like each other area, would have its own Advisory Committee, elected by itself, which would have charge of such questions as labour, rails, permanent way, rolling stock, car equipment, and priority for materials. He hoped all tramway authorities would conduct all negotiations for tribunal exemptions through the Board of Trade Committee, which had been given a seat on the Ministry of National Service. Referring to the labour question, Mr. Devonshire said that in Glasgow 92 per cent. of the tramway employés were women. Concerning the prevention of rush traffic at certain hours, he advocated an arrangement by which big works should open at varying times, as adopted in London, which had been a great relief to the tramways. It was also worth while asking ladies to finish their afternoon shopping before 5 p.m. Some tramway authorities, by a course which in pre-war times would have been considered very prudent, were now hoarders of materials, and they would have to be talked to. There was a hope that some rails would be allowed to be rolled, and these would have to be allotted impartially. It would not be possible to purchase new cars, and the Board of Trade might, perhaps, have to determine which undertakings should be partly or wholly discontinued in order that material might be transferred to undertakings of greater importance. The Ministry of Munitions had already made a complete survey of the tramways of the country, and if it became necessary to declare any non-essential, he hoped tramway owners would render every assistance.

The Conference decided upon the establishment of a single Lancashire area, each municipality or company, whether large or small, to have a single representative, and the lessors also to have one representative each on the Advisory Committee. Replying to Mr. Day, of Manchester, the Chairman stated that the Advisory Committee would suggest the amount of compensation for any undertaking which might have to suffer for the benefit of another. Mr. J. Barnard, manager of the Bolton Corporation Tramways, took the office of hon. secretary to the Advisory Committee.

Mr. James Devonshire, on Friday last, at Birmingham, met the representatives of the electric tramway undertakings in No. 4 Area, which includes Birmingham, Leicester, Nottingham, Northampton, the Potteries, and the other tramway undertakings in the Midlands, in conference on the subject of the working of tramways in war time. It was decided to form an Advisory Committee consisting of an officer of each undertaking in the area. Mr. Alfred Baker, manager of the Birmingham Electric Tramways, was appointed chairman, with Mr. R. L. Horsfield as hon. sec. The duties of the Advisory Committee are consultative, and not executive.

On February 19th, a Conference was held at Newcastle-on-Tyne, at which Mr. James Devonshire presided, for the purpose of appointing a local Advisory Committee. After explaining the objects of the B. of T. Tramways Committee, the chairman stated that steps had already been taken to enable tramway undertakings to increase fares beyond the existing statutory maxima, and that it was desirable, to facilitate this movement, that resolutions passed locally advocating such increases should be forwarded to the Committee. The rates chargeable under the Act of 1870 for the carriage of goods or parcels were quite inadequate, and there was reason to believe that they would soon be raised. An Advisory Committee was appointed, with Mr. George A. Carr, of the Newcastle Tramway Offices, as hon. secretary.

In reply to questions, Mr. A. L. C. Fell stated that one of the duties of the Committee was to value materials and plant released by the closing of tramways, and to assess the compensation payable therefor and for the loss of revenue. By making arrangements with the Woolwich Arsenal authorities the L.C.C. tramway system had been enabled to carry three times as many passengers as previously, and the peaks had been adjusted so that they had a constant load for several hours.

**Blackpool.**—With over six weeks to run, the receipts on the Corporation tramways are already £10,000 ahead of last year's record. The receipts from April 1st last to February 14th were £104,069, and nearly 3¼ million more passengers were carried. The receipts per car-mile at 1s. 10½d. show an increase of 2d. The increased receipts during the past month amounted to nearly £2,000.

Motor Vehicles.—The Cleansing Committee has already three electric motor vehicles in service, and last week decided to add another to the fleet, at a cost of from £800 to £900.

**Bury.**—Year's Working.—There is a profit of £4,299 on the working of the tramways for the past year, including £1,457 transferred from the reserve fund.

**Glasgow.**—Too high a speed on a sharp curve—darkness and the misapplication of the mechanical brake being also factors—was the cause assigned by Colonel Pringle, Board of Trade inspector, for the overturning of a Glasgow tramcar on December 5th last, whereby three persons were killed and 56 injured. Colonel Pringle comments on the fact that the car was driven by a lad of 16, and recommends raising the age limit to 18. The employment of women as tramcar drivers has not been an unqualified success, due to their incapability of standing the strain of responsibility and physical effort involved. Out of 800 women trained by the Corporation, only 266 have been retained. Colonel Pringle adds that perhaps something could be done to reduce the strain and physical effort in tramcar driving by shortening the hours of duty, giving longer intervals of rest, minimising the effects of exposure to weather, and by better illumination in the streets, and thereby to induce them to undertake the responsibilities in larger numbers.

**Leeds.**—The system of parcel distribution by tramway, which is shortly to be commenced in Leeds, is, in one essential respect, entirely unlike that which has been in operation in Bradford for many years. The cars will be special parcel cars, leaving the central parcel depôts for the various districts—and *vice versâ*—at set times each day, and will not carry passengers, whereas in Bradford the parcels are carried largely on the ordinary tramcars, accompanied, sometimes, by a uniformed parcel boy and a hand-truck, and motor vans are also in use. The parcel cars at Leeds will have a distinguishing sign by which passengers will recognise them at sight. In the absence of adequate petrol and horse transport, the traders of the city are offering to lend hearty support to the scheme.

**Liverpool.**—The Tramways Committee is to present a requisition to the Board of Trade, asking for:—(1) 200 men to bring into use 100 cars urgently required on the streets, but sent into the sheds for want of labour; (2) 35 additional motor-omnibuses; and (3) about £50,000 value of materials required in connection with the undertaking.

**Llandudno.**—The Llandudno and Colwyn Bay Electric Railway Co. has formally accepted the notice of the U.D.C. to terminate next January the contract under which it supplies energy for the working of the light railway.

**London Electric Railways.**—The report of the London Electric Railway Co. for the past year shows that war conditions have greatly increased the traffic on all the underground railways, leading to serious difficulties at some of the stations at the rush hours, which cannot at present be met by improved facilities. The expenses of operation have also increased. The gross receipts of the London Electric, Metropolitan District, Central London, and City and South London Railway Companies, and the London General Omnibus Co., Ltd., amounted to £6,661,863, an increase of £623,334 over the corresponding period, and the expenses increased by £609,964, of which nearly half was due to increased war bonus to the staff, raised from 10s. to 21s. per week, and converted into war wages. The total increase in the wages bill by the end of 1917 was at the rate of £500,000 a year. Increased fares came into force in August. The combined earnings of the five companies after paying operating expenses, debenture interest, and preference dividends, and providing for reserves, were £520,337, an increase of £13,370. The London Electric Railway Co. receives 30 per cent. of this amount, or £156,101, making, with £24,474 brought forward, a total of £180,575; after allocating £10,000 extra to reserve and paying 1½ per cent. dividend on the ordinary shares for the year, £30,656 remained to be carried forward.

The through service to Watford on the L. & N.W. Railway and the Bakerloo Railway was inaugurated on April 16th. Previously passengers changed at Willesden, and the revenue was £16,953; as the result of the through service (for 8½ months) the year's receipts increased to £58,362. Out of 25,000 employés over 14,500 are or have been on war service, of whom 902 have been killed and 1,075 wounded, 204 being prisoners of war or missing.

The electrification of the L. & N.W. line from Watford to Euston has been completed as far as Queen's Park, but the work on the remaining section has been stopped by the Ministry of Munitions.

The electrification of some of the suburban lines of the London and South-Western Railway has resulted in an increase of nearly 10 million passengers as compared with 1915. The service has proved so popular that houses are at a premium in the districts served. The extension of the electrification has had to be deferred, and the electric rolling stock cannot be increased at present to meet the needs of the traffic.

**London Tube Railway Breakdowns.**—Three of the London tube railways were disorganised at a busy hour on Monday morning, and thousands of passengers proceeding to the City were inconvenienced. The railways were the Bakerloo, the Piccadilly, and the Hampstead and Highgate tubes, and stations as far apart as Earl's Court and Watford were affected.

The trouble arose from the shoe of a train on the Bakerloo line becoming loose at Paddington. The mishap automatically caused all signals on the Hampstead, Piccadilly, and Bakerloo lines to go to danger. A Bakerloo train stopped outside Warwick Avenue Station, but the driver of the following train, thinking the signals had failed, went on very slowly, and his train came into collision with the stationary train. The passengers on the stationary train alighted at the platform, but those on the colliding train had to walk back through the tunnel. The passengers were unhurt, but three employés, including a motorman, were seriously injured.

The short-circuit at Paddington presumably caused heavy surges of current throughout the railway system. Fires burst out in the motors of two tube trains. In one case the train had just entered Paddington Station, and the passengers were able to alight without difficulty. The second case occurred in a tunnel between Golders Green and Hampstead stations, and smoke poured out from the first coach. The lights in the train went out, and passengers, becoming alarmed, rushed to the rear of the train. The rear doors were opened, and the passengers climbed on to the line and walked to Golders Green, which is aboveground. Meanwhile smoke had been seen issuing from the tunnel mouth, and assistance was sent. The driver, F. Cavalier, remained at his post, and, with the assistance of some passengers, extinguished the flames with sand.

**Morecambe.**—Owing to the shortage of motor spirit, the Morecambe Tramways Co. have had to adopt gas for driving their petrol-electric cars between Morecambe and Heysham.

**North Staffordshire Railway.**—Lord Anslow, presiding at the annual meeting of the North Staffordshire Railway Co., stated that an electric shunting locomotive in connection with quarry works at Oakamoor had been provided, and was working most satisfactorily. Electric track circuiting was being proceeded with, and being put more and more into use. This was a great factor in the safety of their railway working. The company was also going in for the electric lighting of signals, which would effect a great saving in petroleum and in labour.

**Rawtenstall.**—The Corporation tramways in January carried 23,000 more passengers than a year ago, with 1,844 fewer car-miles run, the receipts per car-mile rising by over 3d. In order to prevent overcrowding, instructions have been issued that not more than 75 passengers must be allowed on one car.

**Rochdale.**—Electric Vehicles.—The three electrically-driven motor vehicles which the Cleansing Committee recommends shall be purchased will cost about £5,000. Two of them will be 5-ton vehicles and one 3½ tons. The vehicles will be in use during the night time by the cleansing department, and in the day time by the Gas and Electricity Committee for the cartage of coal and ashes, the latter Committee being charged 1s. 10d. and 1s. 8d. per ton respectively.

**Southport.**—Tramway Purchase.—The T.C., on Feb. 19th, decided to purchase the estate of the Southport Tramways Co. for £35,000, less the sum of £1,200 to be repaid on revenue account. The transfer is to be effected as from January 1st, and the actual working by the Corporation commences to-day.

## TELEGRAPH AND TELEPHONE NOTES.

**Guernsey.**—The annual report for 1917 of the Guernsey States Telephone Department, of which Mr. R. McLean is the manager and engineer, shows that the income from all sources was £7,841, and the expenditure £7,288, leaving a net profit of £553. The number of subscribers' lines, &c., was 2,281, an increase of 46; the mileage of wire was 1,544 overhead, and 1,060 underground. The number of calls dealt with was over 1½ millions.

**Halifax.**—Two boys were fined 10s. each, last week, at the local Police Court, for throwing stones at telephone insulators. It was stated that recently 87 insulators on telephone poles in that locality had been broken by stone throwers.

**Night Telegrams.**—The Postmaster-General announces that, on account of the difficulty of obtaining sufficient messengers and the reduction of all travelling facilities, it is impracticable to continue the delivery of telegrams for the whole of the London postal area throughout the night. Telegrams for addresses within a radius of four miles of the Central Telegraph Office or West Strand Telegraph Office will be delivered up to 10 p.m., and after that hour if the text seems to indicate special urgency. The delivery of telegrams for more distant parts of the London postal area will, however, cease at 8 p.m. Telegrams bearing telephonic addresses will be delivered at all times from the Central Telegraph Office by telephone, as well as telegrams for telephone subscribers who have registered addresses and have given standing instructions for telephonic delivery.—*Daily Telegraph.*

**Wireless Equipment on Submarines.**—According to the *New York Times*, wireless communication is so vital to submarine boats that the problem has been attacked with unusual energy. Improvement in wireless equipment and methods has been amazing. Even at the beginning of the war the methods were comparatively crude, and the most remarkable advance has come only within the past few months.

At first a special mast was set up amidships when the U-boat came to the surface, and the aerial was strung from the top of it to the ends of the deck. The aerial was thus raised 8 ft. or 10 ft. at most. Such an aerial would receive messages from perhaps 200 miles. The sending radius was naturally limited. The next step was to raise two masts, one at either end of the boat, and string the aerial between them. Telescopic masts then appeared, marking a great advance. When the submarine came to the surface, these masts were quickly pulled out to their extreme length of perhaps 15 ft.; the range for both sending and receiving messages was thus much increased.

Several German boats have been captured carrying an ingenious device for winding up the antenna automatically in order to save a few priceless seconds. The wire is coiled up instantly by a spring.

The newest German device for extending the range of wireless signalling is the use of balloons. The success of the U-boats is believed to be largely due to this. Antennæ are raised to a height of at least 2,000 ft. above the sea by means of two balloons connected by a stiff rod. When an enemy is sighted, they are pulled down quickly by means of a windlass operated by electricity. The balloons are painted partly white and partly blue, so that they are scarcely distinguishable from the sky. It is practically impossible, therefore, to bring them down with anti-aircraft guns. With the antennæ raised to the height of half a mile, it is possible to receive wireless communications from almost any part of the world. Some U-boats nowadays displace 1,500 tons and have a cruising radius of 6,000 miles.

The U-boats are also equipped with sound-transmitting devices, which may be classed as wireless signalling apparatus.

# CONTRACTS OPEN AND CLOSED.

## OPEN.

**Aberdare.**—March 31st. Electricity and Tramways Department. Stores for 12 months. See "Official Notices" February 22nd.

**Australia.**—MELBOURNE.—April 5th. Department of the Navy. Motor-driven hydraulic pump.

June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

**Belfast.**—March 13th. Tramways and Electricity Committee. Six or 12 months' supply of stores, &c. See "Official Notices" February 22nd.

**Cavan.**—March 4th. B. of G. Storage battery, wiring, electrically-driven pumps, pipes, &c. See "Official Notices" February 15th.

**Dublin.**—March 8th. Electricity Supply Committee. 1,760 yards of 3½-in. fibrous troughing. See "Official Notices" to-day.

**Fleetwood.**—March 11th. U.D.C. Mechanical stoker for the electricity department. See "Official Notices" to-day.

**Keighley.**—Keighley and Bingley Joint Hospital Board. Electricians' work at Keighley War Hospital for a year.

**London.**—H.M. Office of Works. March 4th. Six months' supply of electrical accessories. Controller of Supplies, King Charles Street, S.W.

**Macclesfield.**—March 18th. Cheshire County Asylum. Stores (10). Electrical goods for six or twelve months. Forms from W. G. F. Tingay, Parkside, Macclesfield.

**Manchester.**—March 12th. Corporation Tramways. (*a*) Permanent way special trackwork. (*b*) Copper rail bonds. General Manager, 55, Piccadilly, Manchester. Specifications for (*a*) 21s. (returnable).

**Portsmouth.**—March 12th. Tramways Committee. Six months' supply of tramway stores. See "Official Notices" February 22nd.

## CLOSED.

**New Zealand.**—The Public Service Tender Board, Wellington, has accepted the following tenders:

30,000 porcelain insulator cups, £562.—J. A. Redpath & Sons.
60 miles twin-twisted rubber-insulated wire, 1/20, £1,305.—Richardson, McCabe & Co.
*New Zealand Shipping and Commerce.*

**Government Contracts.**—List of new contracts placed in January, 1918:—

X-Ray apparatus.—Watson & Sons (Electro-Medical), Ltd.
Copper wire cord.—Shropshire Iron Co., Ltd.
Generating sets.—H. T. Boothroyd, Ltd.; Lyon & Wrench, Ltd.
Motors.—H. T. Boothroyd, Ltd.; Electrical Apparatus Co., Ltd.; Electrical Construction Co., Ltd.; Mather & Platt, Ltd.
Iron & steel wire.—J. C. Hill & Co., Ltd.; Rylands Bros, Ltd.; Shropshire Iron Co., Ltd.
Works services.—Electric lighting: Ellis & Ward, Ltd.; Jackson & Boyce.

H.M. OFFICE OF WORKS.

Electric bell fittings.—Siemens Bros & Co., Ltd.

POST OFFICE.

Protective apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.
Telegraph apparatus.—Isenthal & Co., Ltd.
Telephone apparatus.—Peel-Conner Telephone Works, Ltd.
Testing apparatus.—Evershed & Vignoles, Ltd.; Reid Bros., Engineers, Limited.
Telegraph cable.—British Insulated & Helsby Cables, Ltd.; General Electric Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; C. Macintosh & Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros & Co., Ltd.; Western Electric Co., Ltd.
Telephone cable.—Western Electric Co., Ltd.
Cords for telephones.—British Insulated & Helsby Cables, Ltd.; Peel-Conner Telephone Works, Ltd.; Phœnix Telephone and Electric Works, Ltd.
Cable distribution plugs.—British Insulated & Helsby Cables, Ltd.
Insulator spindles.—Bullers, Ltd.
Bronze wire.—T. Bolton and Sons, Ltd.; British Insulated & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated with the London Electric Wire Co., & Smiths, Ltd).
Galvanised iron wire.—Dorman, Long & Co., Ltd.; Ryland Bros., Ltd.; Shropshire Iron Co., Ltd.; Whitecross Co., Ltd.

PUBLIC WORKS, IRELAND.

Electrical works and supplies, Belfast District.—A. Stevenson.

# FORTHCOMING EVENTS.

**London Association of Foremen Engineers.**—Saturday, March 2nd. At 7 p.m. At the Cannon Street Hotel, E.C. Paper on "Painting and Wood-Finishing from the Engineer's Standpoint," by Mr. A. S. Jennings.

**Salford Technical and Engineering Association.**—Saturday, March 2nd. At 7 p.m. At the Royal Technical Institute. Paper on "Road Transport," by Mr. H. Hodgson and Mr. N. E. Box.

**Chief Technical Assistants' Association.**—Saturday, March 2nd. At 3 p.m. At the Tavistock Hotel. Annual general meeting.

**Royal Institution of Great Britain.**—Saturday, March 2nd. At Albemarle Street, Piccadilly, W. Lecture on "Problems of Atomic Structure," by Prof. Sir J. J. Thomson, F.R.S.

**Greenock Electrical Society.**—Thursday, March 7th. At 7.45 p.m. At 22, West Stewart Street. Juniors' night.

**Institution of Civil Engineers.**—Tuesday, March 5th. At 5.30 p.m. At Gt. George Street, S.W. Paper on "Modern Developments in Gasworks Construction," by Mr. A. Meade.

**Royal Society of Arts.**—Wednesday, March 6th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "The Foundation of Industrial Peace," by Mr. A. H. Paterson.

Monday, March 4th. At 4.30 p.m. (Cantor Lecture.) "The Effects of the War on the Economic Condition of the United Kingdom," by Mr. E. Crammond. (Lecture III.)

**Institution of Electrical Engineers.**—Thursday, March 7th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "The Control of Large Amounts of Power," by Mr. E. B. Wedmore.

**(Dublin Local Section).**—Friday, March 8th. At the Royal College of Science. At 8 p.m. Ordinary meeting.

**Association of Mining Electrical Engineers (West of Scotland Branch).**—Saturday, March 9th. At the Royal Technical College, Glasgow. At 4.30 p.m. Paper on "Conservation of Exhaust Steam and its Utilisation," by Mr. J. Watson.

# NOTES.

**Electrical Goods for Use in Ontario.**—The Hydro-Electric Power Commission of Ontario has sent out a notice regarding the sale of electrical products in the Province of Ontario, dated January 1st, and stating that the Commission orders that on and after three months from the date of the notice no electrical machinery, apparatus, appliances, devices, material, or equipment may be used or disposed of in the Province of Ontario unless the design and construction of the same has been submitted to the Hydro-Electric Power Commission, and approval of such has formally been obtained.—*Electrical World.*

**Large Increase in Use of Electric Appliances.**—During the year just closed the sale of electric domestic appliances in the U.S.A. showed a tremendous advance, chiefly due to the growing scarcity of domestic labour; another factor in the increased purchase of appliances has been the better earnings received by the wage-earners generally. A total of 13,545 electrical appliances were placed on the Minneapolis General Electric Co.'s lines during the period from January 1st to November 1st, 1917. Electric flat-irons were the most popular of all devices sold, the total numbering 4,601. Electric vacuum cleaners were next, the total being 3,091. The other appliances in the order of number of sales ranged as follows:—Toasters, 987; washing machines, 612; heating pads, 401; grills, 384; curling irons, 343; percolators, 324; ranges, 223; air heaters, 214; vibrators, 154; water heaters, 138; luminous radiators, 96; chafing dishes, 85; hot plates, 84; miscellaneous, 1,807.—*Electrical World.*

**Volunteer Notes.**—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending March 9th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

*Officer for the Week.*—Lieut. W. J. A. Watkins.

*Next for Duty.*—Second Lieut. E. A. Ullmann.

Monday, March 4th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, March 5th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, at 7.30.

Wednesday, March 6th.—No. 1 Company, Entrenchment, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, March 7th.—No. 2 Company, Entrenchments, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, March 8th.—Musketry, 5.30—8.

Saturday, March 9th.—Knotting, lashing, and splicing for the whole corps, 2.45—4.45. Musketry, 2.45—4.45.

*Special Notice.*—All drills will take place at Headquarters, unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

**Hydro-electric Power and University Instruction.**—With the development of hydro-electric power in the Alpine and other regions of France, certain industries (*e.g.*, electro-chemistry, electro-metallurgy, general mechanical engineering, paper making, &c.) are also being developed *pari passu*. Grenoble, which is in the centre of important hydro-electric undertakings, thus assumes great importance. The Polytechnic Institute attached to the University evidently means to keep pace with the requirements which will grow for technically-trained men for the electrical and allied industries. In an article in *La Nature* for February 9th the director of the Polytechnic gives an outline of the courses held at the institute. The establishment comprises (1) a higher school of electro-technics for training electrical engineers, electro-chemists, electro-metallurgists, &c.; (2) an elementary electro-technical school; (3) an electrical standardising and testing laboratory; (4) a school for the paper-making industry; (5) a paper-testing laboratory; (6) an electro-chemical and electro-metallurgical test station with a 1,000-H.P. experimental plant. A chair of electro-chemistry and electro-metallurgy has also been established at the University.

The article referred to gives further particulars as to numbers of students, the granting of diplomas, &c., and it is stated that the courses in question will be open to foreign students who have had a higher education in a college or similar establishment.

**B.E.A.M.A.**—We are informed that the following firms have been elected members of the British Electrical and Allied Manufacturers' Association :—

| | |
|---|---|
| Abbott, Anderson & Abbott, Ltd. | London. |
| Atlas Carbon and Battery Co., Ltd. | London. |
| British Battery Co., Ltd. | Watford. |
| British Central Electrical Co., Ltd. | London. |
| British Ever-Ready Co., Ltd. | London. |
| Concordia Electric Wire Co., Ltd. | London. |
| Crighton & Co. | Stockport. |
| Davenport Engineering Co., Ltd. | Bradford. |
| Ecco Battery Co., Ltd. | London. |
| Efandem Co., Ltd. | Wolverhampton. |
| Film Cooling Towers, Ltd. | London. |
| Fleming, Birkby & Goodall, Ltd. | Liversedge. |
| Foster Instrument Co. | Letchworth. |
| Lancashire Water Cooler Co. | Salford. |
| Mackley, E. N., & Co. | Gateshead. |
| Manley, J. W. | New Barnet. |
| Quead, Ltd. | London. |
| Sunlight Manufacturing Co., Ltd. | London. |
| Trevelyan & Co. | Birmingham. |
| Vulco Dry Battery Co. | London. |
| Ward & Goldstone | Salford. |

**Fatality.**—An inquest was held recently at Haltwhistle into the death of John Kennedy, electric pump man at South Tyne Colliery, who was found dead in the pump house. Medical evidence described the circumstances under which Kennedy was found, and concluded that Kennedy had received an electric shock. The broken nose must have been due to the fall. The trousers were scarred where the knee had been burnt. The man's lamp had been found lying beside him still burning, which could also account for the knee being burned. The colliery manager, Mr. W. E. Donald, said that, so far as they knew, the electrical installation was quite in order. As the pump stopped, the deputy went to see what was the matter, and found the body.

**National Insurance (Part II) (Munition Workers) Act, 1916.**—The following is a further decision of the Umpire :—Contributions are payable in respect of :—

2,414 X. All workmen engaged in removing wire, canvas, or other foreign substances from rubber waste preparatory to the recovery or reclaiming of the rubber.

This decision amplifies decision A 1,639 X (*Board of Trade Journal* of August 24th, 1916).

**"Safety First."**—As a result of the "safety first" campaign, the number of accidents per 100,000 miles run by the London General 'Bus Co.'s vehicles last year was reduced to 22½ per cent. below that of 1916, and the number of fatal accidents was reduced by 27·8 per cent.—*Daily Chronicle.*

**Electric Motor Vehicles.**—In connection with the existing prohibition of the use of petrol motor vehicles except for business purposes, it was announced in Parliament, last week, that there is at present no official intention to issue regulations as to the consumption of electricity by vehicles used for purposes of pleasure on similar lines to those in force as regards the use of petrol, petrol substitutes, or gas.

**Institution and Lecture Notes.—Allen West Engineering Society.**—The usual fortnightly meeting of the above Society was held on February 19th, at Brighton, when a paper was read by Mr. F. G. Smith, joint managing director of Messrs. Wellman, Seaver & Head, Ltd., entitled "Steel Works Charging Machinery." The speaker dealt very fully with the design and construction of various types of charging machines, and showed in a very lucid and forcible manner the service to which these machines were subjected; as he was addressing employés of an electric control firm, he pointed out the operations each individual motor and controller was called on to do, and placed before the Society various electrical problems which had arisen in connection with steel works machinery. An interesting discussion followed the paper, and in seconding a vote of thanks to the author, Mr. Allen West pointed out the enormous advantage to the members of the Society in having such an authority as Mr. Smith come to Brighton to tell them of steel works machinery. The co-operation of mechanical and electrical engineers in dealing with such problems would ultimately lead to improved designs and closer standardisation.

**The Association of Engineering and Shipbuilding Draughtsmen (Merseyside Branch).**—At the Liverpool University on Thursday, 21st inst., under the auspices of the Association, a paper was read by Mr. D. S. Macbeth on "Technical Education in its Relation to Draughtsmen." The author dealt with the subject from three points of view, viz.:—The draughtsman's work, his training for that work, and his prospects. He opened with a brief survey of the varied problems with which the draughtsman has to contend, showing the need of a scientifically trained mind, and insisted that admission to the drawing office should in all cases be by examination, as was now done by several firms, thereby ensuring that none but those showing a natural inclination for the work would be accepted. Comment was made on the interest which some firms were now taking in the education of their apprentices, and on the excellent system of Messrs. Cammell, Laird & Co., of Birkenhead. Mention was also made of the desirability of firms providing a library of technical books for the use of their employés.

**Association of Mining Electrical Engineers.**—At a meeting of the Yorkshire Branch, at Doncaster, on Saturday, a paper by Mr. V. A. Chitty on "Reinforced Concrete Poles for Transmission Cables" was read. A discussion afterwards took place.

**Institute of Metals.**—The annual general meeting is to be held in London (at Burlington House), on March 13th and 14th. President-Designate, Prof. Carpenter. The presidential address will be delivered. Five papers are down for reading.

**Institution of Mechanical Engineers.**—The annual report of the Council shows that at the end of 1917 the membership stood at 6,306, a net increase of 59. The accounts show a total revenue of £22,866 and expenditure £22,701 (including £9,943 invested for reserve funds), leaving a surplus of £165. The total assets amount to £144,319. The names of over 1,000 members have been recorded as being on active service; during the past year 22 gave their lives for their country.

**The Centralisation of Electric Power.**—"The Supply of Electricity for All Purposes" was the subject of an address given by Mr. W. A. Chamen before the members of the Cardiff Business Club recently. Mr. Chamen said that the benefit of adequate, efficient, and cheap supplies of electricity could not be realised unless the generation of electricity for all purposes was grouped together into a few centres where large and highly-efficient power stations could be erected. A large amount of capital was sunk in municipal as well as in company undertakings, and if the centralisation of electric power production was to be realised, it obviously became necessary to find some means by which the company and the municipal interests could be brought together. The municipality on the one hand, and the electric lighting and power companies on the other, together with the general public as a whole, would all eventually benefit by this centralisation. To continue as they were at present simply meant keeping up the price of electricity for an unlimited time above what it need be, and that without real advantage to anybody concerned.—*S. Wales Daily News.*

**Wages in the Gas Industries.**—Representatives of the gas industries, municipal and otherwise, and of the workers in gas undertakings, met Sir George Askwith at the Ministry of Labour, on February 21st, to discuss the questions of wages and conditions of employment. The proceedings lasted for two-and-a-half hours, and were adjourned till yesterday, no decision having been arrived at.—*Times.*

**L.C.C. Employés.**—Wages Awards.—Among recent awards by the Committee on Production and the Special Arbitration Tribunal is the following (quoted from the *Times*) relating to London County Council employés (main drainage, fire brigade, asylums, and highways services):—(1) Hammermen and engineering labourers working as mates to fully qualified engineers, electrical fitters, and boilermakers; and (2) men in the Engineering Department of the Fire Brigade, the war wages advances granted to engineering and foundry trades; all other workmen such advance as will make their aggregate war wages advances up to 16s. per week.

**Inquiry.**—The address of "Messrs. O. G. & Co.," makers of the "Acme" vibrator, small motors, &c., is asked for.

**Whist Drive.**—The Bury Corporation electricity department employés held a whist drive and dance in aid of the Lancashire Fusiliers' Prisoners of War Fund. Mrs. S. J. Watson, wife of the borough electrical engineer, distributed the prizes.

**Demobilisation Problems.**—The General Council of the National Alliance of Employers and Employed is calling for the setting up of a Central Statutory Board representative of employers and employed to regulate and supervise the reinstatement in normal employment of civilian workers now in Government or controlled establishments, the reinstatement in civil employment of the present Forces, and any general redistribution of labour arising out of the war. Mr. F. Huth Jackson recently said that the Ministry of Munitions, which was the biggest employer of labour in the country, was not included in the recent announcement on the matter made by the Minister of Labour.

Already the Government is, for several reasons, brought right up against the problems of demobilisation of munition workers even while the end of the war is quite out of sight. Its experience on this limited scale brings home at once the urgent need for seeing that plans are made well in advance of that immense demobilisation of labour which must take place when the war ends and the transfer which must follow the return of the soldiers to their former places in the workshops. There have been various reports in the papers during the past ten days which show that we have a sufficiency of certain munitions to last for more than 12 months, and as the bringing in of food from America involves cutting down the supplies of raw materials for those particular lines of munitions, there will be a slowing down in a number of the factories, at any rate for a time. Shipbuilding, aeroplane, and some other special classes will not be interfered with in this way. In the House of Commons on Tuesday, Mr. Kellaway, Parliamentary Secretary to the Ministry of Munitions, referred to the manner in which the Government was handling present labour demobilisation. We quote from the *Times* report :—

"The problem of the discharges of women munition workers could not be dealt with solely on economic lines. It might be said, for instance, that the limited production which had now become necessary should be concentrated in those factories where it could be most cheaply turned out. That was a policy one would wish to adopt if the times were normal, but it was not a policy which a man in the responsible position of Minister of Munitions would in these grave times care to enforce too rigidly. In a time of war the country could not afford to have large numbers of unemployed and discontented people if there were any means by which it could be avoided. The problem had to be mitigated by a number of ameliorative measures. They could see that the men and women it was found necessary to discharge were discharged in such areas where there was the best chance of their getting immediate work. They could extend the time of contracts. Instead of holding a contractor to his engagements to produce a million shells in six months, they could give him 12 months to do it in. They could also abolish overtime, Sunday work, and night shifts. He did not say it was desirable to do all, or any of those things, but all, or any of them, might be done if necessary, in order to prevent distress arising from the reduction of their programme of production. If he did not go as far as many members could wish, it was because he had in mind that steps taken now in connection with this limited and experimental demobilisation might carry us far when the time came for carrying out the general demobilisation after the declaration of peace. No one appreciated more highly than he did the magnificent services which the women munition workers had rendered in making our Armies the best equipped Armies in the world. He would be the last man to cause hardship to the women munition workers by a soulless application of the policy of reduction in output. It was because of the splendid work of those women that our reserves were so enormous that we could face this reduction caused by a limitation of material without fear as to its military effect. So far as he was able to influence the policy of the Ministry, it would not be guided exclusively by financial considerations, and, particularly, they should not forget the debt of gratitude they owed to the women munition workers."

In answer to a Parliamentary question, Mr. Kellaway says that the number of women munition workers who have been dismissed or received notice of dismissal during the last three weeks as a result of the termination of certain contracts is about 8,000. He regrets that a certain amount of hardship is inevitable, but everything that can properly be done will be done to reduce the hardship. There are openings for a considerable number of women in agriculture, in shipyards, and in other occupations. The machinery of the labour exchanges and of the National Service Department is being utilised to its fullest capacity in order to bring the women who may be displaced into these other forms of national service. The possibility of giving priority in employment on war work to these women is under discussion. The suggestion that the Minister should authorise the issue of free railway warrants home is receiving sympathetic consideration. Other suggestions—*e.g.*, the payment of wages for a certain period—are being examined by the Departments concerned in conjunction with the Treasury. An Inter-Departmental Conference was held on Tuesday by the President of the Board of Trade, the Chairman of the War Cabinet Committee on Unemployment, to consider these and other aspects of the problem.

**Niagara Power Commandeered.**—The International Railway, Buffalo, N.Y., will be affected by an order of the War Department seizing all of the electrical energy produced, imported, and distributed by the Niagara Falls Power Co., the Hydraulic Power Co., and the Cliff Electrical Distributing Co., Niagara Falls, N.Y. There will be a complete redistribution of electric power among industries in Western New York, so that war industries will have all the electric power they need. The railway will be forced to rely largely upon its steam-generated power. Fortunately, the railway steam plant has been held in reserve in case of a breakdown in the Niagara Falls power.—*Electric Railway Journal.*

**The New Electroculture.**—Writing in the *Daily Mail* this week, Dr. F. Chamier puts forward remarkable claims for a system of electroculture which involves the use of buried wires and electrodes, supplied with current which is "intermittently high tension and continuous" for a few hours every two to six weeks. As the result of this treatment applied to crops, the yield is said in some cases to have been quadrupled. Only 10 per cent. of the fertilising material at present employed is required and sour land can be made sweet and fruitful. A dilute solution of picric acid is applied to the soil in connection with the process. Seed is also subjected to "small doses of high-frequency current" with great effect upon its germinating powers.

We would not discourage any inventor from experimenting in this field, nor do we suggest that the overhead discharge is the only possible method of stimulating the growth of crops; but we must confess that the claims put forward by Dr. Chamier will need the strongest support by actual demonstration before we can accept them as worthy of credence. Such methods as he advocates have hitherto given disappointing results in the hands of various investigators, and, in view of the infinitesimal proportion of the current flowing between electrodes a considerable distance apart, that would pass through the soil near the surface, and the infrequency of the application to boot, we can only regard his method as comparable in intensity to homœopathic treatment, and affording little ground for anticipating noteworthy results.

**Nitrogen from the Air.**—President Wilson has signed an order authorising the construction of a water-power plant at Muscle Shoals (Alabama) as part of the $60,000,000 project for the fixation of atmospheric nitrogen for use in the manufacture of munitions and fertilisers.

**The Manchester Meeting of the I.M.E.A.**—The preliminary programme is issued of this year's Convention of the Incorporated Municipal Electrical Association, which is to be held at Manchester on June 20th and 21st. The meetings will be held in the Council Chamber of the Town Hall. No invitations will be issued to visitors on this occasion. The programme is, of course, at present subject to revision, but, as far as can be foreseen, it will be as follows :—After the welcome by the Lord Mayor on the morning of Thursday, June 20th, Mr. S. J. Watson, the borough electrical engineer of Bury, will deliver his presidential address, and a discussion on "The Future of Electric Power Supply" will follow. In the afternoon there will be visits to the works of the British Westinghouse Co. at Trafford Park, and of the Manchester Corporation Electricity Department (Stuart Street power station). On Friday the discussion on electric power supply will be resumed, and the annual general meeting will follow.

**U.S. Ordnance Base in France.**—The American Ordnance Base Depôt, which is now being built in France for the repair and salvage of ordnance material, will cover an area of over 2½ million sq. ft., and will accommodate several thousand employés, requiring about 8,000 KW. of electrical apparatus.

**Linking-up in California.**—For the period of the war, and in the interest of fuel economy, the Pacific Gas and Electric Co., the Great Western Power Co., the Sierra and San Francisco Power Co., and the Universal Electric and Gas Co. have agreed to operate their systems under one management. Under this plan several stand-by plants can be shut down without endangering continuity of service as provided by the joined systems. By operating only those centrally located stand-by plants whose efficiency is highest, a great saving of fuel oil will be effected, and loads will be distributed so that water storage on each system can be used to maximum advantage.

The unified service will be continued as long after the war as such action may be deemed to be in the interest of the public. The combined systems serve about 40,000 sq. miles, believed to be the largest area yet administered by a single management. The total generating capacity of the combined system at present is about 377,600 KW., of which 240,000 KW. is hydro-electric power and the remainder steam.

The immediate requirements for 1918 of the four chief power companies supplying the San Francisco Bay region call for an increase of more than 200,000,000 KW.-hours of energy and more than 50,000 KW. peak capacity, as compared with 1917. The future growth in power requirements of the companies operating in the Bay region will necessitate the expenditure of over $5,000,000 annually to provide generating plants and transmission lines alone to meet the demand.—*Electrical World.*

**Appointments Vacant.**—Draughtsman (£190) for the Sunderland Corporation electricity department; electrical fitter (40s. + 14s. + 12½ per cent.) for the City of Chester electricity works; shift engineer (£3 + 12½ per cent.) for the Radcliffe U.D.C. electricity department; charge engineer (£160 +) for the City of York electricity department; switchboard attendant for the Borough of Nuneaton electricity department; engine driver (40s.) for the Tunbridge Wells Borough electricity works; clerk for Rotherham Corporation electricity department; meter tester (£3) for the Borough of Salford Electricity Departments; electrical engineers, wiremen, fitters and engine drivers for the Southern Command power stations; electrician (depôt foreman) for the Borough of Dover Tramways Department. See our advertisement pages to-day.

**Concert.**—The eighth annual concert organised by the Southport Corporation Tramways and Electricity Employés' Social and Athletic Society was held last week. The proceeds were devoted to the wounded and disabled members of the tramway and electricity depôts and the Southport Infirmary.

**The Tramways Committee.**—The Tramways (Board of Trade) Committee has removed to No. 8, Buckingham Gate, Westminster, London, S.W. 1 (Telephone, Victoria 6200; Telegrams, Trambotcom Sowest London), and all communications, in future, should be addressed to the Secretary, Mr. J. N. Wilson, at that address.

## OUR PERSONAL COLUMN.

**Central Station and Tramway Officials.**—Included in the recommendations for increases of salary to be brought before the Leeds City Council at its meeting on Wednesday were the following:—Mr. C. N. Hefford, manager electricity department, £800 to £1,000; Mr. J. Burbidge, electrical engineer for the tramways department, £500 to £550; Mr. W. T. Green, assistant manager in the electricity department, £475 to £525; and to Mr. A. Daggett, traffic superintendent in the tramways department, £345 to £400.

The salary of the electrical engineer at Fleetwood is to be increased by £25 per annum.

The Huddersfield T.C. has approved by a majority the recommendation to increase the salary of the tramways manager (Mr. R. H. Wilkinson) from £500 to £600.

The Halifax T.C. has been recommended to increase the salary of the electrical engineer (Mr. W. M. Rogerson) from £700 to £800, and that of the tramways engineer (Mr. J. W. Galloway) from £325 to £375.

Mr. John Lloyd, for nearly 40 years general manager of the Southport Tramways Co., Ltd., who has retired, has been presented by the staff and employés with a gold watch and chain and an illuminated address, and a case of brushes from the Birkdale Electric Supply Co., Ltd., with a silver dressing case for Mrs. Lloyd.

The Burton-on-Trent T.C. has advanced the salary of the electrical engineer (Mr. Hall) from £400 to £500 a year.

The Dover Corporation Tramways Committee has recommended the appointment as manager of Mr. E. H. Bond, the present works superintendent, and that his salary be increased to £4 per week.

Mr. E. Carden, late manager of the Corporation tramways at Dover, has been presented by the staff with a silver cigarette case.

**General.**—Mr. W. G. Wickham, H.M. Trade Commissioner in South Africa, is expected to arrive in this country in April on an official visit. Firms who desire to interview him may do so in London at the offices of the Department of Overseas Trade for several weeks soon after Easter. He will subsequently visit the provinces. Applications for appointments for interviews should be made as soon as possible to the Comptroller-General of the Department, 73, Basinghall Street, E.C. 2, quoting reference number D.O.T. 2,873/18.

Mr. H. Garstang has been nominated by the Executive Committee of the Blackburn Chamber of Trade to represent the electrical trade on an employers' panel for assisting the Advisory Committee in difficult cases of substitution.

Mr. H. D. Wilkinson has removed from Queen Street Place to offices at 56, Victoria Street, S.W. 1.

Mr. E. Kilburn Scott has been appointed consulting engineer to the British American Nitrates Co., of New York. Mr. Scott left England in January to deal with the exploitation of his patents for manufacturing nitrates electrically, and will be in America for some time. His present address is c/o the British American Nitrates Co., 299, Broadway, New York.

**Roll of Honour.**—Wireless Operator Gilbert Lambert, R.N.V.R., formerly on the staff of the Folkestone Electricity Supply Co., Ltd., was killed in the naval raid in the Straits of Dover on February 15th.

Wireless Operator C. S. Harrison, killed whilst serving on a drifter in the raid on the Dover patrol, on February 15th, was before joining the Forces a student at the Royal Technical Institute, Salford, where he gained the diploma in electrical engineering.

Bombardier K. M. Street, electrical engineer, has gained the Military Medal for bravery, and on account of serious wounds is to be discharged.

Company Quartermaster-Sergeant Wm. Aspin, East Lancashire Regiment, who has died at home from bronchial pneumonia, was on the staff of the Blackburn Corporation tramways.

Private G. Trevassa, Devon Regiment, who was prior to the war engaged at the Newton Abbot electricity works, has fallen in action.

Private A. P. Goddard, Toronto Regiment, formerly engaged at the Tunbridge Wells Corporation electricity works, has died after being buried by a shell, and after the amputation of a leg.

Private J. T. Mawson, who has been wounded, is an electrical engineer who, having been at the Vulcan Motor Works, took up an appointment with the British Columbia Electric Railway Co., which he held for six years.

Sapper T. Mawdesley, R.E., aged 35, has been drowned by the sinking of the *Aragon*. He joined the Army in November last, while employed as electrician at Rufford Hall.

The French Legion of Honour has been won by Private A. J. Bailey, Manchester Regiment, formerly employed on the Manchester Corporation tramways.

Lance-Corporal H. Cooper, formerly a motorman on the Ashton-under-Lyne Corporation Tramways, has been awarded the Croix de Guerre, with bar, the Legion of Honour, and the Medaille Militaire for deeds of great gallantry. On Friday the Mayor of Ashton handed him a gold watch from the members of the Ashton Swimming Club.

Company Sergeant-Major W. Woods and Regimental Sergeant-Major G. Imisson, York and Lancaster Regiment, both of whom were on the staff of the Sheffield municipal tramways, have been awarded the Belgian Croix de Guerre for valour. The latter already possesses the Distinguished Conduct and Military Medals.

**Obituary.**—Mr. James Mitchell Hewitt, consulting engineer of Hale, near Altrincham, joined the Manchester express for London on Monday evening. His dead body was found on the railway between Matlock and Darley Dale Station, but Manchester reports state that there was nothing to show how the mishap occurred. Mr. Hewitt was 60 years of age.

The death occurred on February 17th of Mr. Edward Alan Christian, electrical engineer, formerly on the staff of the Manx Electric Railway Co. and the Mersey Railway Co. He was 38 years of age.

## REVIEWS.

*Electrical Equipment.* By H. W. Brown. London: Hill Publishing Co. Price 12s. 6d. net. Pp. 229, + xiii; 109 figs.

There can be but little doubt that hitherto there has been a considerable gap between the general electrical text-books and the highly specialised works each dealing with a particularly detailed subject. Electrical pocket-books have to a limited extent filled the void, but the volume now under consideration is one which will appeal strongly to many beside those for whom it is specially written. It is pleasing to find in one cover a practical account of the equipment required in a works, presented in such a manner that it should be possible for even a tyro to follow it, though it must be admitted that there are sections which appear to be needlessly involved; at the same time, it must be remembered that the author is catering for American conditions, and in many cases the English requirements are totally different; but if the book is read and followed with an up-to-date pocket-book, there should be no difficulty in picking out those portions which would apply to modern practice in this country.

In the introduction, penned by the Head of the Electrical Department of Cornell University, it is explained that the work is based upon notes prepared by Mr. Brown to guide the student in his work, which is so mapped out as to prepare him for the more practical side of electrical engineering. In this respect the courses of instruction of our own universities are distinctly lacking; for, although they aim at giving the student a practical insight into the profession, they do not impart such knowledge as will enable him thoroughly to appreciate the working details required in actual installations, nor do they inculcate that commercial spirit which is met with as soon as he enters an office or works. "Electrical Equipment" covers these points in an admirable manner, and should do much to assist in this respect. Beyond this, it should enable works managers and mechanical engineers, who may have under their care an electrical equipment, to grasp essentials much more readily than any other work we know of. When extensions are required, a perusal of its pages would be of immense help, and possibly preliminary facts and figures could be put forward with far less trouble than if they were without its aid. Throughout the pages references are made to standard American books, and to an English reader the work suffers somewhat in this respect, but we hope that the publishers will see their way to produce a British edition at a date when the prices of materials are more settled than at the present moment.

In the first chapter the use of diagrams is explained, and many hints regarding their preparation are given. The next chapters generalise on the requisites of power plants and the choice of system; they make interesting reading, but in many cases in this country there is not much choice possible, and the user is obliged to take what is offered unless he is willing to introduce his own plant, and even then there may be local considerations which will put out of court the arguments set out in this book. The chapters on D.C. motors, A.C. motors, converters, and transformers are comprehensive without being laboured, giving just that information which will be found essential in understanding their possibilities and limitations. There are statements which are open to question; for example, "The best voltage (D.C. motors) for industrial plants is generally 220 volts; but if no motors are over a few hundred feet from the generator, 110 volts may be used." Regarding transformers, the information given should be of very great help to the works engineer.

The subject next dealt with is that of storage batteries, special mention being made of their application for portable service. A chapter on illumination follows, the topic being treated in a short but practical manner. D.C. transmission and distribution systems are next discussed, and here one is struck by the thorough manner in which the points are dealt with from both the electrical and commercial points of view; the tables which, in addition to the usual data, give approximate costs are, of course, American, but could easily be adapted to British needs. When we arrive at the question of A.C. transmission, however, the context becomes somewhat more technical, as might be expected, and while the student

fresh with theory will no doubt easily peruse the matter, the practical man will be apt to flounder. The next two chapters on generators (D.C. and A.C.) are of considerable interest, and the impression is gained that the author has gone to a very great trouble to convey a large amount of general information in as small a compass as possible. It is this which tends to make the work so valuable. Regulating transformers and instrument transformers comprise the subjects following, and here much that is usually hidden away in a highly specialised and technical work is set forth. Similarly, the information regarding the controlling and regulating equipment, circuit breaking equipment, lightning arresters, and measuring and indicating apparatus is presented in a manner which should appeal strongly to those who have control of such apparatus.

The subject of motor applications is well handled, and it is hoped that the empirical formulæ which are given regarding horse-power will be even further extended when a new edition of the work appears; this chapter, together with the chapter on costs, is novel, and should do much to enable the student to appreciate the practical and commercial side to a greater extent than is usually met with at present, and they should also be of assistance to those contemplating extensions and wishing to put before their superiors the electrical end of the question without calling for outside help. If the student intelligently works through the problems with which the text concludes, he will be better able to understand the why and wherefore of the subject, and when, in every-day life, he comes in contact with the materials discussed, he will be in a much more favourable position to appreciate its use.

We feel sure the book will have the success it deserves, and will do much to increase the efficiency of thought and action of the beginner in power station and works experience; it should assist those whose practical train of thought is more developed, while it will also prove a handy volume of reference for those whose work does not demand such a first-hand knowledge of electricity as the others possess.

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*Power Wiring Diagrams.* By A. T. DOVER. London: Whittaker & Co. Price 6s. net. Pp. 208.

The first glance at Mr. Dover's book makes it quite evident that it cannot be exhaustive. A book of 208 pages suitable for the pocket cannot contain more than a fraction of the possible standard power wiring diagrams, without mentioning innumerable minor variations to suit special circumstances.

On the whole, Mr. Dover has made his selection fairly representative, though he has certainly included too many diagrams and illustrations of the manufactures of one particular firm. About 40 per cent. of the total illustrations are of a general character, not specially applicable to any maker. Of the remaining illustrations, nearly one-half show details of apparatus made by one firm, and about another 20 per cent. of these named illustrations are confined to a second firm. No other firm's goods have anything like as many, and the result is rather unfair to those who are but slightly represented, or are not represented at all. It is probable that war-time conditions are largely responsible for this state of things, but in future editions it would be desirable to hold a more even balance between the claims of various makers.

It would be obviously impossible to include all the diagrams of power-wiring connections that are called for from time to time. At first sight many of the special diagrams shown would seem to be unnecessary, as makers always send out such diagrams. These, however, have a habit of being mislaid when most wanted, and there is no doubt that a pocket-book containing such information will be of considerable value to many engineers. Certain sections might be extended, as, for example, that dealing with lifts, which has only two diagrams of lift controllers on D.C. work, and none at all for A.C. supply. The section dealing with accumulator work also is not very complete.

It must have been, however, an almost impossible task to select the most representative diagrams, and it is probable that future editions will show the need of considerable expansion in the size of the book.

The contents are divided up in very convenient sections, details of which are summarised fully in the table of contents, whilst a very complete index is added at the end. The list of conventional signs adopted is also very clear, and a special word of praise is necessary for the diagrams, which form a large proportion of the illustrations and which are exceptionally distinct. The letterpress is well written, and enables the diagrams to be followed without difficulty, whilst also giving much useful information as to the needs for certain switchgear and control apparatus.

## NEW COMPANIES REGISTERED.

**Oldham Rubber Mills, Ltd.** (149,693).—Private company. Registered February 22nd. Capital, £2,000 in £1 shares. Manufacturers of and dealers in substitutes for leather, rubber, gutta-percha, oil-cloth, linoleum, steam and electric packing, manufacturers of articles in which such substitutes are used (including clothing), &c. The subscribers (each with one share) are:—L. Nicholas, 19, Castle Street, Liverpool, chartered accountant; H. H. Tattersall, 21, Bouverie Street, Liverpool, accountant's clerk. The first directors are to be appointed by the subscribers. Qualification, 100 shares. Solicitors: E. Berry, 37, Moorfields, Liverpool.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Ferranti, Ltd.** (83,718).—Capital, £130,000 in 60,000 pref., 60,000 ord., and 10,000 def. shares of £1 each. Return dated January 11th, 1918. 53,374 pref., 60,000 ord., and 10,000 def. shares taken up; £123,374 considered as paid. Mortgages and charges: £124,815.

**Gosport & Alverstoke Electric Lighting Co., Ltd.** (82,693).—Capital, £5,000 in £10 shares. Return dated December 28th, 1917. All shares issued; £5,000 paid. Mortgages and charges: Nil.

**Keynsham Electric Light & Power Co., Ltd.** (64,634).—Capital, £5,000 in £1 shares (3,000 pref. and 2,000 ord.). Return dated January 12th, 1918. All shares issued; £5,000 considered as paid. Mortgages and charges: £2,980 (excluding interest).

**Imperial United Lamp Co., Ltd.**—Mortgage dated January 24th, 1918, to secure £11,000 and a bonus not exceeding 10 per cent. charged on land at Osmaston, Derby, and the company's undertaking and general assets.

**A. Vernon Ward (Hove), Ltd.**—Memorandum of satisfaction in full on January 25th, 1918, of debentures dated February 16th, 1917, securing £500, has been filed.

**Siemens Bros. Dynamo Works, Ltd.**—Debenture dated February 1st, 1918 (as collateral security for £630,000, part of £1,300,000 debenture stock secured by trust deed dated January 15th, 1918), charged on the company's undertaking and property, present and future, including uncalled capital (subject to £200,000 debenture stock covered by deed of 1907). Holder: Public Trustee.

**Electrical Contracts & Maintenance Co., Ltd.**—Memorandum of satisfaction in full on February 12th, 1918, of debentures dated June 25th, 1917, securing £3,000, has been filed.

**East India Tramways Co., Ltd.** (74,457).—Capital, £100,000 in 15,000 pref., 35,000 ord., and 50,000 def. shares, all of £1 each. 7,476 pref., 33,433 ord., and 50,000 def. shares taken up; £1 per share called up on 7,476 pref. and seven ord.; £7,489 paid, including £6 on 24 pref. shares forfeited. £83,426 considered as paid on 33,426 ord. and 50,000 def. Mortgages and charges: Nil.

## CITY NOTES.

**St. James's and Pall Mall Electric Light Co., Ltd.**

Mr. W. LEAF, presiding at the annual meeting on Tuesday, said that the report was highly satisfactory, showing increases in revenue, profits, and dividend. The output had increased by over 700,000 units, and the revenue by over £17,000, largely from the 10 per cent. addition to charges to consumers. Cost of generation rose by £7,000. They were increasingly dependent upon the Central Electric Supply Co. Whereas in 1916 they took from that source roughly 20 times as much current as they generated themselves, in 1917 they took nearly 30 times. They generated just over 500,000 units, and purchased about 15,000,000. The Central Co. was the backbone of their own and the Westminster Co.'s business, and they had every reason to congratulate themselves upon the establishment of the joint system. A large turbo-generator was now in course of erection in place of the one that they had on order over a year ago, when it was requisitioned by the Government. The loss of the set for the winter's load prevented the saving in coal consumption that they intended, but they got through without strain. They had also been able to maintain their large winter stock of coal; the chief difficulty lay in handling it for the largely increased output. The cost of the new unit and of some important additions at Grove Road would involve capital expenditure which would be met by a loan from the two parent companies. In regard to the future, the outlook was not particularly rosy. The exceptionally mild weather this winter compared to last had reduced their revenue from electric heating; "Summer Time" had been extended by about five weeks; and there was an increase in expenses. There would be further advance in the price of labour, coal, and other materials, and the total expenditure would probably increase by from £10,000 to £12,000. For these reasons they were carrying forward a larger balance than usual, and notifying consumers of a further advance in charges of 10 per cent. as from the end of the March quarter.

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**Liverpool Overhead Railway Co.**—At the annual meeting, on Tuesday, the chairman, Mr. H. C. WOODWARD, referred to the sudden death of the secretary, Mr. W. H. Alexander, who had been associated with the company since its formation, over 25 years ago. The passengers carried showed a decrease of 65,306 on the year. The total expenditure on railway and tramway was £85,406, an increase of £12,012, due to the higher cost of coal and all other stores and materials, and the additional war bonus to the employés. During the past 12 months the war bonus paid was about £13,000, and it was estimated that in the present year it would amount to £20,000. They carried last year 3,400,000 more passengers than in 1913, with about the same train mileage, and this larger traffic had considerably taxed the accommodation of their rolling stock, particularly at certain times of the day. They ran a two minutes' service in the busiest hours, which was as much as could be done with safety, but even then there was some congestion. The difficulty of obtaining necessary supplies, even at very high prices, naturally added to the anxieties of the general manager and his colleagues.

**W. T. Henley's Telegraph Works Co., Ltd.**—In a circular issued to the ordinary shareholders, the directors state that the time has arrived for the conversion into a separate organisation of the factory and business of solid and pneumatic motor tires, which was created a few years ago as a branch of the business.

The tire business was established by means of the capital furnished by undivided profits of the company, and the business has met with considerable success, the products of the factory already having obtained a good reputation, and the directors consider that there is every prospect of the business continuing to improve after the close of the war.

It is proposed to form a tire company having a share capital of £200,000, which is approximately the amount of capital that the company is employing in the tire business. The whole of the shares in the tire company will be held by Henley's company, who will thus retain the entire control of the business. The directors considered the possibility of distributing among the shareholders by way of bonus, the whole or part of the shares in the new tire company, but they came to the conclusion that such a course would not be in the interests of the company, as the control of the tire company might in time be divorced from the parent company. As, however, the directors consider that the time has arrived when the capital of the company should be made more nearly to represent the capital actually employed in the business, they have decided to recommend the shareholders to increase the ordinary share capital by £200,000, making it £400,000, and to distribute as a bonus the additional capital of £200,000 amongst the shareholders in proportion to their holdings. Very considerable reserves have been created from undivided profits, which reserves have been largely employed by the company in trading, including, as stated above, the establishment of the tire factory, and a part of these reserves will be used to pay up the new shares.

The directors also propose to recommend that the ordinary shares of £5 each shall be divided into five shares of £1 each.

The proposals are subject to the consent of H.M. Treasury.

**National Electric Supply Co., Ltd.**—At the meeting, at Preston, on February 20th, Mr. J. Booth said the year had been one of increasing expenses and considerable anxieties for all electric supply companies. Considerable economies had been effected by the new steam turbine generator, but wages and salaries were considerably higher. Practically as much was paid on account of rates and taxes last year as the shareholders received in dividends. The basis on which the company was assessed was most unfair, when compared with undertakings which were in the hands of municipalities, and which got the benefit of high assessments in the increased amount of rates. Efforts were being made to remedy that matter, for, as a result of the assessment at the present time, consumers were having to pay a higher price for electric light and power than would otherwise be the case.

**Northampton Electric Light & Power Co., Ltd.**—During 1917 operations have included important developments. The new riverside works have been delayed in consequence of labour shortage, and delays in steel and other materials. Total connections equivalent to 260,247 lamps (32 watts). New connections 17,394 (equiv.). Large increase in heating and cooking stoves. Motors increased from 5,144 to 5,475 H.P., of which 3,795 are let out on hire. Units sold increased by 11.3 per cent. 14,000 shares issued in November largely oversubscribed. After paying pref. dividend, putting £6,450 to depreciation, and paying 6½ per cent. on the ordinary shares, £1,668 is to be carried forward.

**Central London Railway Co.**—At the annual meeting, Lord G. Hamilton said that they had participated in increased traffic due to the reduction in services of surface transport undertakings, but expenses had increased in equal degree, and the maintenance of the property could only be carried out with the greatest difficulty on account of the shortage of materials. They must maintain substantial reserves to meet this deferred maintenance when circumstances permitted it to be carried out. If the upward tendency of wages and prices continued they would have to make further fare increases.

**British L. M. Ericsson Manufacturing Co., Ltd.**—The accounts for 1917 are of an exceptionally favourable character; the company gains strength yearly. The profit constitutes a record, and future prospects are excellent. Net profit after charging £12,588 for depreciation, £8,247 for income-tax, £2,500 for debenture interest, amounts to £72,512, plus £15,072 brought forward. After paying the preference dividend, and 8 per cent., free of tax, on the ordinary shares, placing £11,000 to reserve, and £5,000 to a reserve account for extra depreciation, £57,585 is to be carried forward (subject to Excess Profit Duty).

**Tyneside Tramways & Tramroads Co.**—After paying the preference dividend, and 5 per cent. for the year on the ordinary, a bonus of 2s. per share, less tax, is paid on the latter, £1,400 is put to renewals, depreciation, &c., £1,000 is put to special reserve, £600 is written off balance of registration and formation expenses, and £1,312 is to be carried forward. Traffic receipts for the half-year show an increase of £6,051 compared with the corresponding period of 1916; for the whole year the increase was £11,590.

**Fife Tramway, Light & Power Co.**—The annual meeting was held in Edinburgh Mr. Wm. Low, the chairman, said that the Dunfermline & District Tramways paid over to the company by way of dividend and management fees £17,050, compared with £15,000 for the preceding year. The company was in a very sound position for raising additional capital when required, having power to issue £275,000 of debenture stock as and when required.

**Mansfield & District Tramways, Ltd.**—Dividend on ordinary shares for the year 8 per cent., less tax, and £1,000 to reserve, carrying forward £1,677.

**Telegraph Construction & Maintenance Co., Ltd.**—For 1917 the net profit was £115,227, after charging interest on debentures. Adding £112,750 brought forward there is a total of £227,976. An interim dividend of 5 per cent, already paid is followed by a further dividend of 10 per cent., together with a bonus of 12s. per share, free of tax, absorbing £67,200. To reserve fund £20,000, £10,000 to the pension fund, carrying forward £108,336.

**Metropolitan District Railway Co.**—Lord George Hamilton, addressing the annual meeting, said that nearly one-half of the increase in the expenses (£609,964) was due to higher wages and the war bonus paid to the staff. In reply to criticism by Sir R. Perks, he said that during the year they had increased their rates to an extent which in a full year would bring in about £400,000 extra to the combined companies.

**Rushden & District Electric Supply Co., Ltd.**—For 1917 favourable progress is reported. Consumers increased from 151 to 171, and motors from 459 to 568 H.P. Units sold increased 22 per cent. Revenue from sale of current increased from £3,060 to £4,181. Dividend 5 per cent., carrying forward £136.

**Ramsgate & District Electric Supply Co., Ltd.**—Gross profit for 1917, including £860 brought forward, £3,438. After allowing for 5 per cent. interest on outstanding accounts due to contractors, a dividend of 3 per cent. is paid, £1,000 is placed to reserve, and £665 is to be carried forward.

**Tramways, Light & Power Co., Ltd.**—After paying the preference dividend and putting £7,500 to reserve, £5,277 is carried forward. Fair progress has been made, notwithstanding the difficult conditions for all such undertakings.

**City of London Electric Lighting Co., Ltd.**—Preference dividend 6 per cent. for the year; ordinary share dividend 16s., at the rate of 8 per cent. for the year.

**Kensington & Knightsbridge Electric Lighting Co., Ltd.**—Dividend of 4 per cent. on the ordinary shares for the December half-year, making 7 per cent. for the year.

## STOCKS AND SHARES

Tuesday Evening.

Stock Exchange markets have subsided into a quiet and rather a dull condition. The last state of Russia is a malinfluence that begins to make itself felt in markets generally, but in spite of the various political upheavals, the appetite for industrials continues keen, and active conditions prevail amongst manufacturing shares connected with electrical work. There have been particularly sharp movements in Electric Constructions.

At one of last week's meetings of proprietors, the chairman spoke rather hopelessly of the difficulties that have arisen over transporting Londoners by underground. So great is the traffic that its handling has become a very serious problem. He spoke of a possible necessity for another revision of fares, but held out cold comfort to season-ticket holders who cannot find seating accommodation in either of the two classes. Meanwhile the quotations for the stocks show a drooping tendency. The only shaft of light thrown on the railway position is the extremely cautious hint of a possible raising of dividends heard at the recent meetings of the Great Western and the North-Western Companies.

Electric Constructions took a jump to 30s. 6d. on vague optimisms in the direction of "amalgamation"—that blessed word to which the old lady's Mesopotamia is now a bad second. There was a most unwonted excitement about the market, an excitement badly dimmed by a rush of profit-taking which reduced the price to 26s. 3d. again. British Westinghouse preference have also been strong, advancing briskly to 63s. before the reaction occurred that left them a little lower, though a fair rise remains on the week. These £2 shares are entitled to 15 per cent. non-cumulative dividend, and for some time past have received 7½ per cent. Besides amalgamation rumours, hopes are entertained in bullish quarters that the dividends may steadily approximate their full level. At the present price, the yield to a buyer is comparatively small. Other electrical industrials are firm to good, but, with holders disinclined to sell, the market is necessarily very narrow.

Supply shares keep strong. A demand for London Ordinary is something of a feature It is said in the market that one of the big provincial centres has been trying hard to obtain shares. The Government scheme for centralisation of electricity supply is making steady progress. The only change in the price list is a rise of ¼ in London Ordinary, the rest of the shares remaining hard at their previous levels.

Henley's at the moment are unchanged at 17½, but in view of the scheme which the directors have just propounded for dividing the business into two parts, there are buyers only

for the shares. The scheme involves a distribution to shareholders which will probably have the effect of putting the price still better, and, although something of the sort has been rather expected for some time past, the definite proposals come as a pleasant confirmation to the optimists. Callenders at 16 are 10s. up on the week. Telegraph Constructions remain at 43, unaffected by the excellent figures of the report. Crompton Ordinary and Preference are both 18s., Edison Swans remain about 33s., and other industrials in this department are noticeably good.

British Columbia Electric Preference stock has recovered 6 points to 52, and private advices from Vancouver this week give a much more satisfactory account of the condition in that city than have been reported until just lately. Canadian issues as a whole are inclined to pick up; Canadian General Preferred at 106 is a point to the good. In other colonial and foreign descriptions, there is not much change. Brazilian Tractions weakened to 44, but recovered again to 45. Manila Electric Capital stock has improved to 74½. The Mexican group remains stagnant. There has been a little buying of the 5 per cent. Debenture stock of the Anglo-Argentine Tramways.

Telegraphs are steady with the exception of West India and Panama, which reacted ½ after their meteoric rise. Marconis have come on offer, with the parent shares at 3 and Americans at 23s. 6d. The dulness is associated in the market with the lack of interest shown by the public in the shares for the time being. The rubber market is also dull, although the price of the produce has risen a little. Iron and steel descriptions are mostly firm, but the leading armament shares reacted to some extent after their previous buoyancy.

## SHARE LIST OF ELECTRICAL COMPANIES.

| | Dividend 1915. | Dividend 1916. | Price Feb. 26, 1918. | Rise or fall this week. | Yield p.c. |
|---|---|---|---|---|---|
| **Home Electricity Companies.** | | | | | |
| Brompton Ordinary | 10 | 9 | 6¼ | — | £6 18 6 |
| Charing Cross Ordinary | 5 | 5 | 4 | — | 6 5 0 |
| do. do. do. 4½ Pref. | 4½ | 4½ | 3¼xd | — | 6 18 6 |
| Chelsea | 4 | 5 | 5/8 | — | 5 4 4 |
| City of London | 5 | 5 | 18½ | — | 6 0 9 |
| do. do. 6 per cent. Pref. | 6 | 6 | 10½ | — | 5 18 6 |
| County of London | 7 | 7 | 11½ | — | 6 4 5 |
| do. 6 per cent. Pref. | 6 | 6 | 10½ | — | 5 18 6 |
| Kensington Ordinary | 7 | 6 | 5¾ | — | 5 11 7 |
| London Electric | 3 | Nil | 1¾ | + ¼ | Nil |
| do. do. 6 per cent. Pref. | 6 | 4 | 3¾ | — | 5 18 6 |
| Metropolitan | 5 | 5 | 8¼ | — | 4 12 4 |
| do. 4½ per cent. Pref. | 4½ | 4½ | 6½ | — | 6 18 4 |
| St. James' and Pall Mall | 8 | 8 | 7½ | — | 6 4 2 |
| South London | 5 | 5 | 5 | — | 6 18 4 |
| South Metropolitan Pref. | 7 | 7 | 21/6 | — | 6 10 6 |
| Westminster Ordinary | 7 | 7 | 7 | — | 6 8 7 |
| **Telegraphs and Telephones.** | | | | | |
| Anglo-Am. Tel. Pref. | 6 | 6 | 94½ | — | 6 7 0 |
| do. Def. | 33/6 | 1½ | 32½ | — | 5 18 4 |
| Chile Telephone | 5 | 5 | 7½ | — | 5 10 4 |
| Cuba Sub. Ord. | 5 | 7 | 9½ | — | *7 11 4 |
| Eastern Extension | 8 | 8 | 15½ | + ½ | 5 6 0 |
| Eastern Tel. Ord. | 8 | 8 | 152½ | — | *5 5 7 |
| Globe Tel. and T. Ord. | 7 | 7 | 14½ | — | *4 18 3 |
| do. Pref. | 6 | 6 | 10½ | — | 5 17 1 |
| Great Northern Tel. | 22 | 24 | 86 | — | 6 11 6 |
| Indo-European | 18 | 18 | 54½ | — | 6 6 8 |
| Marconi | 10 | 15 | 3 | — ½ | 5 0 0 |
| Oriental Telephone Ord. | 10 | 10 | 4½ | — | 3 17 2 |
| United R. Plate Tel. | 8 | 8 | 7 | — | *5 14 4 |
| West India and Pan. | 6d. | 6d. | 1½ | — ½ | *2 19 2 |
| Western Telegraph | 7 | 8 | 15½ | — | *5 5 0 |
| **Home Rails.** | | | | | |
| Central London, Ord. Assented | 4 | 4 | 62½ | — | 6 9 1 |
| Metropolitan | 1 | 1 | 22 | — ½ | 4 11 0 |
| do. District | Nil | Nil | 15½ | — | Nil |
| Underground Electric Ordinary | Nil | Nil | 1¾ | — | Nil |
| do. do. "A" | Nil | Nil | 5/8 | — | Nil |
| do. do. Income | 6 | 4 | 85½ | — | *4 19 6 |
| **Foreign Trams, &c.** | | | | | |
| Adelaide Sup. 6 per cent. Pref. | 6 | 6 | 4¾ | + ½ | 6 3 1 |
| Anglo-Arg. Trams, First Pref. | 8½ | 8½ | 2¾ | — | — |
| do. 2nd Pref. | 6½ | — | 2½ | — | — |
| do. 5 Deb. | 5 | 5 | 66 | — | 7 11 6 |
| Brazil Tractions | 4 | 4 | 45 | — | — |
| Bombay Electric Pref. | 6 | 6 | 9½ | — | 6 6 4 |
| British Columbia Elec. Rly. Pfcs. | 5 | 5 | 53 | +6 | 9 12 4 |
| do. do. Preferred | Nil | Nil | 30½ | — | Nil |
| do. do. Deferred | Nil | Nil | 23 | — | Nil |
| do. do. Deb. | 4½ | 4½ | 69 | — | 7 1 7 |
| Mexico Trams 5 per cent. Bonds | Nil | Nil | 97 | — | Nil |
| do. 6 per cent. Bonds | Nil | Nil | 84½ | — | Nil |
| Mexican Light Common | Nil | Nil | 17½ | — | Nil |
| do. Pref. | Nil | Nil | 29 | — | Nil |
| do. 1st Bonds | Nil | Nil | 88 | — | — |
| **Manufacturing Companies.** | | | | | |
| Babcock & Wilcox | 15 | 15 | 84/6 | — | 4 10 4 |
| British Aluminium Ord. | 7 | 10 | 17/6 | — | 6 0 9 |
| British Insulated Ord. | 17½ | 20 | 82 | — | 5 6 8 |
| British Westinghouse Pref. | 7½ | 7½ | 31 | + 1/6 | 4 5 10 |
| Callenders | 20 | 20 | 16 | + ½ | 6 5 0 |
| do. 5 Pref. | 5 | 5 | 4 | — | 6 5 0 |
| Castner-Kellner | 22 | 20 | 80 | — | 5 12 2 |
| Edison Swan, fully paid | — | — | 23 | — | Nil |
| do. do. 4 per cent. Deb. | 4 | 4 | 70½ | — | 5 6 0 |
| Electric Construction | 7½ | 7½ | 14 | + 1/6 | 5 9 1 |
| Gen. Elec. Pref. | 6 | 6 | 14½ | — | 5 15 8 |
| do. Ord. | 10 | 10 | 19½ | — | 5 2 7 |
| Henley | 25 | 25 | 17½ | — | 7 2 10 |
| do. 4½ Pref. | 4½ | 4½ | 4 | — | 5 12 2 |
| India-Rubber | 10 | 10 | 142 | — | *6 15 7 |
| Telegraph Con. | 20 | 20 | 43 | — | *5 11 8 |

* Dividends paid free of income-tax.

## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

### Wednesday, February 27th.

| CHEMICALS, &c. | | Latest Price. | Fortnight's Inc. or Dec. |
|---|---|---|---|
| a Acid, Oxalic | per lb. | 1/8 | .. |
| a Ammoniac Sal | per ton | £75 | .. |
| a Ammonia, Muriate (large crystal) | " | £72 | £4 inc. |
| c Bisulphide of Carbon | " | £28 | .. |
| a Borax | " | £38 | .. |
| a Copper Sulphate | " | £67 10/- | .. |
| a Potash, Chlorate | per lb. | 2/6 | .. |
| a " Perchlorate | " | 3/- | .. |
| a Shellac | per cwt. | £23 10/- | £3 15/- inc. |
| a Sulphate of Magnesia | per ton | £16 | .. |
| a Sulphur, Sublimed Flowers | " | £35 | .. |
| a " Lump | " | £25 | .. |
| a Soda, Chlorate | per lb. | 1/- | .. |
| a " Crystals | per ton | 17o/- | .. |
| a Sodium Bichromate, casks | per lb. | .. | .. |
| **METALS, &c.** | | | |
| c Brass (rolled metal 2' to 12' basis) | per lb. | .. | .. |
| c " Tubes (solid drawn) | " | .. | .. |
| c " Wire, basis | " | .. | .. |
| c Copper Tubes (solid drawn) | " | 1/7 to 1/7½ | ¼d. inc |
| g " Bars (best selected) | per ton | £147 | .. |
| g " Sheet | " | £147 | .. |
| g " Rod | " | £147 | .. |
| d " (Electrolytic) Bars | " | £135 | .. |
| d " " Sheets | " | £152 | .. |
| d " " Wire Rods | " | £133 | .. |
| d " " H.C. Wire | per lb. | 1/3¼ | .. |
| f Ebonite Rod | " | 3/- | .. |
| f " Sheet | " | 2/6 | .. |
| a German Silver Wire | " | 2/3 | .. |
| h Gutta-percha, fine | " | 6/10 | .. |
| h India-rubber, Para fine | " | 2/8 | 1¼d. inc. |
| i Iron Pig (Cleveland warrants) | per ton | Nom. | .. |
| l " Wire, galv. No. 8, P.O. qual. | " | £42 | .. |
| g Lead, English Pig | " | .. | .. |
| g Mercury | per bot. | Nom. | .. |
| e Mica (in original cases) small | per lb. | 6d. to 3/- | .. |
| e " " " medium | " | 3/6 to 6/- | .. |
| e " " " large | " | 7/6 to 14/- & up. | .. |
| d Silicium Bronze Wire | per lb. | 1/6½ | .. |
| r Steel, Magnet, in bars | per ton | .. | .. |
| g Tin, Block (English) | " | .. | .. |
| n " Wire, Nos. 1 to 16 | per lb. | 4/1 | .. |

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

**Adjustment of Wages.**—At a meeting of the Conference Club (an organisation of large U.S.A. electrical contractors doing an inter-State business), the feature of the programme was a paper on a plan for the automatic adjustment of the wages of labour, by Mr. L. K. Comstock. His proposal related to the periodical adjustment of wages on the basis of the "index numbers," compiled by various authorities, showing the rise in the prices of commodities that make up the cost of living. Assuming that three-quarters of the wage-earner's outlay for the necessities of food, clothing, and shelter follows the trend of these index numbers, Mr. Comstock suggested that if, for example, the accepted index number for April 1st, 1917, was 190, and it rose to 220 by October 1st, 1917, an increase of 15 per cent., a corresponding increase should be granted on three-quarters of a given worker's wage. Such adjustment would preserve his relative earnings unchanged, compared with the rising cost of living. Such a plan of adjusting wages had the merit of immediate practicability. For years the United States Department of Labour had compiled and published an index number which would serve every purpose, while having the stamp of authority. Mr. Comstock urged that both the employer and mechanic frankly admitted that neither could get along without the other, and asked that, making a virtue of necessity, the employer should study sympathetically the needs and requirements of his men, and, likewise, that the Union should see to it that its men worked faithfully and sympathetically for their employers.—*Electrical World.*

**Work for Men Blinded in War.**—A form of occupation ideally suited for sightless men is being developed by the Crocker-Wheeler Co. at its plant in Ampere, N.J. Coils for armatures and similar apparatus must be wound, and no machine has been devised that will do this as well as a workman can do it by hand. The coils of wire are wrapped with tape. Millions of these wire coils are used, and their number is growing each year. Wrapping or insulating them with tape is a kind of work very similar to basket weaving and chair caning.

A workroom started about two months ago has already brought happiness into the lives of a group of blind men and women. They have learned to do the work, and have almost attained the speed of a normal worker.

When these are proficient they will return to their various countries and carry on the work of making the blind self-supporting by instructing the war blind.—*Electrical World.*

## NATIONAL ELECTRICITY SUPPLY.

By A POWER STATION ENGINEER.

(*Concluded from page* 172.)

The report refers to the average price charged by certain municipalities in Lancashire for supplies to tramways and for public lighting, and a statement is made that most, if not all, of these municipal undertakings are only able to supply power at reasonable prices because they make exorbitant charges for traction and public lighting. Before committing themselves to such a statement one would expect responsible engineers and business men to examine the position carefully. It did not, apparently, seem possible that although a few units were supplied, say, at 2.5d. to 3d. for public lighting, or 1d. to 1.5d. per unit for traction, the effect on the balance-sheet of the undertaking might be almost negligible, and in some cases if such units had been supplied without any charge whatever the financial result would not have been seriously affected. Then, again, with regard to the statement that the N.E. Coast companies supply their entire output at a price below an average of ½d. for E.H.T. bulk supplies, large power supplies, and a comparatively small amount of detail distribution, the Committee will be surprised to learn that some of the municipal undertakings in Lancashire are selling over 30 per cent. of their output at prices under .4d. per unit, and 60 to 80 per cent. of the output at prices under .5d. per unit, but by reason of the sales for lighting (at prices in many cases lower than those obtaining on the N.E. Coast), the average price exceeds ½d. per unit. A further point of importance arises in connection with the financial side of the business. The N.E. Coast companies have not had to obtain out of their consumers' pockets year by year the necessary means to reduce outstanding obligations to their proprietors to the same extent as the local authorities, who have reduced their indebtedness by 35 per cent. to 45 per cent. It would have been extremely interesting if a statement had been published in the report to show the capital expended on the N.E. Coast undertaking and the amount which had been set aside out of profits either by way of sums to replace obsolete plant or for reserve and depreciation, and a comparison made with the Lancashire municipalities. A comparison on these lines would undoubtedly show the municipal undertakings to be in a much stronger position than the companies, and yet, in spite of these disabilities, which necessitate a higher charge for the supply than would be required in the case of a company, many of the local authorities regularly show annual results which are much better financially than those shown by the companies.

Another important feature in the report is the general condemnation of the erection of any power station unless it is adjacent both to a colliery and a natural supply of water. It did not appear to occur to the Committee that with the exception of the N.E. Coast there is no case in the country where collieries and a natural water supply are available in the same locality. In the Birmingham district, for instance, although there are plenty of collieries there is probably not a sufficient flow of water to run more than 5,000 to 10,000 KW. without the use of cooling towers; substantially the same conditions obtain in the Sheffield, Leeds, and Manchester districts. The question might well be put to the Committee whether, under these circumstances, they recommend that super-stations should be provided, say, on the Humber, or the Mersey, where water is available for the production of the few million horse-power which would have to be transmitted to meet the requirements of the districts named, and also whether they prepared estimates to show the cost of providing transmission mains and the losses incurred in delivering such requirements into the industrial areas. Surely, they would not have condemned as "most unsatisfactory and the cause of great apprehension for the future" each and every scheme involving the use of cooling towers without constructing a practical scheme as an alternative. So far as one can judge, there does not seem the remotest possibility that the large centres of industry already established in the Midlands, where the demand for power is both large and dense, but where natural water in large quantities is known to be absent, will ever be supplied from power stations situated at any great distance. The capital cost and losses of any known transmission scheme would pay for the additional costs incurred in connection with cooling towers many times over. In the near future, also, it is quite possible that internal-combustion turbines may supersede steam turbines as the most suitable prime mover, in which case there would be no necessity to provide large quantities of circulating water. If all super-stations are to be placed near natural water there will probably be another general scrapping all round at a later date in order again to start afresh on other sites, and cut out the transmission losses.

Regarding the so-called "Power Acts" legislation, there is no particular reason to suppose "that Parliament was convinced that the supply of electricity must be dealt with in a big way." Had this actually been the case, no doubt the Government would have introduced measures which would have insisted on an enlargement of the then existing areas for generating purposes, but such a procedure has never yet been contemplated. The so-called "Power Acts" were passed at the instigation and under the auspices of company promoters who thought they saw a way of exploiting the industry, otherwise they would not have touched the business. The fact that the "Power Acts" emerged in a form "which is complicated and unworkable" is surely no fault of the municipalities, who found it necessary to protect their own interests. The fault, surely, lies with the promoters of the Power Acts, who were evidently satisfied with the powers conferred upon them, because they proceeded to erect stations and afford supplies. They knew, or ought to have known, their limitations, and if they subsequently found themselves in difficulties that is no reason why they should blame somebody else for their own errors of judgment. It is quite true that power companies have been excluded from dealing with the majority of power users because such power users were situated in areas already provided with an electricity supply scheme, but they really have no grievance on the "score of restricted sphere of operations," and "of their inability to get to work on a large scale" when the powers granted to them expressly provided this limitation. It is no more the function of a so-called power company to cater for the special requirements of industry than it is of the various local authorities; both operate under similar obligations to supply all individual consumers. The claim that municipalities have not developed the supply of energy for power purposes is also another mis-statement of fact. Numbers of cases can be put forward where the sales under this heading have increased as fast as new plant could be provided to deal with it. Records show that in many cases the output for such purposes has increased threefold to tenfold during the last decade; equal or better results cannot be shown by many companies. Many local authorities have already shown "the freedom of range and keenness which in a high degree is conducive to the fullest measure of success," although apparently such a spirit ought only to be distinctive of private enterprise.

There are many other points in the report in-

tended to discredit the efforts of local authorities to which exception might be taken, but enough has already been said to show that many of the statements are entirely without foundation.

Although I have felt it necessary to offer criticism on certain portions of the report because of the unfairness of the comparisons made, I do not intend to comment adversely on the main conclusions arrived at by the Committee. It is undoubtedly essential that steps should be taken to improve the position:—(1) The present limited boundaries for generating purposes must be superseded by much larger areas; (2) new authorities must be set up to exercise the powers in such areas; (3) larger generating plant must be provided in specially selected positions to supply the areas at present dealt with by local generating stations; (4) the new authority must acquire and operate as one undertaking all the existing generating stations and main transmission lines in the enlarged area.

It is only by such means that individual users of electrical energy will be able to obtain a supply under the most satisfactory conditions.

I also agree with Lord Haldane's remarks that "whatever conflict there may be between the interests of the local electrical authorities which exist at present and the interests of a comprehensive scheme, there is no conflict in this matter between the interests of the local community and those of the nation as a whole." A manufacturer who requires a supply of electrical power does not really care which type of authority is responsible for such supply so long as it is given at a price which compares favourably with other alternatives and is satisfactory in other ways.

## A NEW PRINCIPLE IN THE FLOW OF HEAT.*

By CARL HERING, D.Sc.

When in the usual combustion process the high-temperature flame impinges on a surface which is maintained at a much lower temperature, as, for instance, in the boiling of water in steam boilers, in cooking utensils on gas stoves, &c., the sudden chilling of the hot gases causes a very thin film of extremely high thermal resistance to form over the flame side of this surface; all the heat which flows usefully from the flame to the water must pass through this very high resistance, which means that the rate of transference of this useful heat is greatly reduced thereby, and that the usual method of boiling water is therefore a very imperfect one.

The thickness of this film seems to be of the order of magnitude of about 0.005 in. If the flame temperature is taken as about 1,350 deg. C., and that of the water is 100 deg., the drop of temperature through this film will be about 1,250 deg. C., showing an extremely high thermal resistivity.

A study of the properties of this film, by the writer, showed that its resistance diminishes greatly as the difference of temperature between its two faces is decreased. The temperature of the flame and of the water being fixed, the only way to accomplish this is to greatly increase the temperature of the fire side of the vessel This can best be done in practice by inserting between the hot and the cold surfaces of the vessel an artificial thermal resistance of such magnitude that the current of heat flowing through it will maintain the hot side at a high temperature. As the difference of temperature between the two ends of a thermal resistance is a function of both the resistance and the flow of heat (like the electrical analogy), and as the greatest possible flow of heat is what is desired, it follows that this artificial resistance should be made of the best possible heat conductor, so that its resistance may be made as low as possible; it should, therefore, be made of metal rather than of insulating materials.

The thermal relations are shown roughly in fig. 1. The ordinates represent the thermal resistances in the path of the heat flow; the abscissæ the temperatures of the flame side of the vessel. The rapidly falling curve *a* then shows approximately how the resistance of this film (or its equivalent expressed in terms of thermal resistance) falls as the temperature of that surface rises. The rising curve *b* shows approximately the thermal resistances which must be inserted to bring that heat-absorbing surface to those temperatures. Curve *c* is the total resistance—that is, the sum of the two others; it is this that governs the flow of heat from flame to water, and it will be seen to have a minimum point P beyond which it is no longer advantageous to increase the artificial resistance. Hence, by increasing this resistance the flow of heat increases greatly up to a maximum point, and then diminishes again. These curves are based on experimental results, and not on theoretical deductions, and they are only approximate, as many other factors enter also.

The greatest heat flow is obtained when the drop of temperature in the artificial resistance is made approximately equal to that in the film; this means that the temperature of the surface at which the heat enters the walls of the vessel should be about midway between the temperatures of the flame and the water, hence about 725 deg. C. (about 1,365 deg. F.), which is a dull red heat. The more this drop of temperature in the artificial resistance is due to the flow of heat and the less it is due to actual resistance, the better. As copper is one of the best heat conductors, the maximum in practice will be obtained when the artificial resistance is made of copper.

Unlike the analogous case of electrical energy, there is no loss of heat energy or efficiency in overcoming these two thermal resistances; all the calories of heat which enter the hot side issue again from the cold side (assuming perfect lateral heat insulation). The resistances therefore affect only the *rate* of transmission through a given cross-section. But indirectly the thermal efficiency in this case increases with this rate; there are always some unavoidable losses of heat, and if a given quantity of water is evaporated by the same flame in, say, half the time, these losses will take place during only half the time, hence will be halved. A distinction must therefore be made between the rate and the efficiency; the writer has succeeded in increasing the rate about 27 times, but the thermal efficiency in ordinary steam boilers is from 25 to 75 per cent., possibly even a little higher in some very good boilers, and therefore it could not be increased 27-fold, though the losses might be reduced to 1/27 of what they were, if the time of heating could be reduced that much.

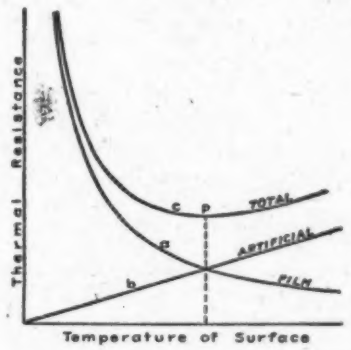


Fig. 1.—The Effect of Thermal Resistance on Heat Flow.

In practice the most convenient way to make these artificial resistances is by attaching metallic lugs to the flame side of the vessel. These must be so proportioned in diameter and length that the heat flow through them will maintain their hot ends at a temperature about half-way between that of the water and the flame, which is at about a dull red heat; unless so proportioned they will not act as described, and merely add a little to the heat-receiving surface. Such lugs, when properly proportioned, act as though they pierced thermal openings through that highly-resisting film through which the heat then rushes into the water very rapidly, as is shown by the water boiling with extreme rapidity directly over the tops of the lugs.

When these lugs are made shorter and thicker, or longer and thinner than they should be, the flow of heat diminishes, as indicated by the curve *c*. As the same thermal resistance may be obtained with short, thin lugs, or with long, thick ones, provided the ratio of the diameters and lengths is the same in both, there is a choice open. Practical considerations, such as the expense, weight, space, &c., will generally decide this.

Theoretically, the best condition would appear to be one lug of the diameter of the bottom surface of the vessel, or in other words, a very thick bottom; but this thickness (corresponding to the length of the lug) would then have to be several feet, making this form of the resistance absurdly impracticable. The other extreme would be to have innumerable very thin short lugs, close together; this is impracticable on account of the expense, the frailty of such thin lugs, and the fact that when maintained at such a high temperature they gradually burn up. Between these extremes there are mean proportions which give the best results, considering the practical conditions.

The lugs may be made slightly conical so that their bases cover practically the whole surface, while their thinner ends

* From the *Journal* of the Franklin Institute, and *Power*, Vol. 47, No. 1. Abstract.

are far enough apart to permit the free circulation of the hot gases. When placed radially on the outside of the tubes of a water-tube boiler, they may be cylindrical, yet have their cooler ends close together and their hot ends farther apart.

The former theory concerning the use of lugs on the heated surface was that they increased the heat-absorbing surface. While it is undoubtedly true that by increasing the surface covered by this film its resistance as a whole is reduced somewhat, yet the writer's researches have shown conclusively that the increased flow is by no means a function of this surface, and that the older theory is therefore quite fallacious, which no doubt explains why this frequently proposed method of increasing the rate by increasing the surface has not come into general use; the principle was not the correct one. Increasing the surface without breaking down the film may give a small percentage increase, but by breaking down the film resistance as described an increase of several thousand per cent. was obtained.

Special attention was given to this theory of the surface in the writer's researches, and many comparative tests were made; the results bore no relation whatsoever to the surface, but they were all in accord with the principle above described.

The manifold increase of flow obtained by properly proportioned lugs refers to the flow through the lugs as compared with the flow through the same area of the vessel as that of the cross-sections of the lugs, and therefore is of interest chiefly in showing the correctness of the principle. In practice this extreme result of 27-fold could not be reached, and probably could not even be very closely approached. The lugs in this case were rather far apart; when closer together the flow in each lug becomes less, but the area covered by them then becomes so much greater that the flow per square inch of total surface of the vessel is greater.

With ordinary tin cups over a quiet Bunsen flame of about the same diameter as the bottoms of the cups, and shielding the sides of the cups from the flame, the same amount of water was evaporated in nearly one-quarter of the time with nearly one-quarter of the amount of gas. If in steam boiler practice the rate could be merely doubled, it would be of great importance, as it would diminish the size of the boilers by about a half.

## NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

*Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.*

### The Wild-Barfield Furnace for Alternating-Current Working.

The alternating-current furnace is similar in construction to the continuous-current furnace, which we have already described, but differs from it only in the means adopted for obtaining an indication as to when the steel in the furnace arrives at the temperature of decalescence and is ready for quenching.

Briefly, the furnace consists of an inner crucible containing molten salt and heated by a wire helix wound on its outer periphery. This crucible is surrounded by lagging material, and is contained in an outer case, on which is wound a coil of copper wire. The heating helix and the outer coil thus constitute the primary and the secondary of a transformer.

The furnace windings are coupled up in series with the primary and secondary windings of an auxiliary induction coil or transformer. The coupling is such that the voltage induced in the furnace secondary winding is opposed by that in the secondary winding of the auxiliary induction coil.

In the secondary circuit is inserted an indicating instrument, which takes the form of a vibration galvanometer.

Before any steel article is introduced into the furnace, the voltages induced in the two secondary coils balance exactly, the galvanometer receives no current, and its "spot" remains perfectly steady. As soon, however, as a steel article is placed in the furnace the steel is magnetised by the heating winding, the total amount of magnetism passing through the secondary winding is increased, the secondary voltage is also increased, balance between this and the secondary voltage of the auxiliary induction coil is destroyed, and an alternating current is circulated through the indicating instrument, which is indicated by the spot vibrating and its image becoming confused.

As soon as the steel arrives at the temperature of decalescence it also becomes non-magnetic; thereupon conditions are restored to what they were before the steel was introduced into the furnace and the "spot" immediately stops vibrating.

It is thus known with certainty that the steel has arrived at its true decalescent temperature, and if it is withdrawn and quenched at once it will be properly hardened without being over-heated, a condition absolutely necessary for all cutting tools of the finest possible grain, and consequently the keenest and most enduring edge is thus secured.

Equally good results may be obtained once in a way by a very highly skilled workman employing other methods, but with this process no skill whatever is required, and the results obtained will be the best possible for the particular steel used, not occasionally only, but every time.

Patents have been applied for by the Automatic & Electric Furnace, Ltd., 6, Old Queen Street, S.W. 1, makers of these furnaces. Fig. 1 shows the complete outfit.

### A New Electrical Alloy.

A copper-nickel alloy, which, it is claimed, replaces German silver and is permanent and non-corrosive, withstanding higher temperatures than German silver, has been developed by the Electrical Alloy Co., of New York City. This alloy is to be known as "Lucero." It is stated that it does not contain any zinc and is very useful for rheostats, car heaters, &c. The specific resistance is 290 ohms per mil-foot (48 microhms per inch), and the temperature coefficient is 0·001 per °F.—*Electrical World.*

### Ironclad Oil-break Switchgear.

The British Thomson-Houston Co., Ltd., of Rugby, have developed a line of ironclad switches known as "type O, Form K," for circuits of small capacity up to a pressure of 700 volts; the type is of simple design, with quick make-and-break, and can be fitted with the usual automatic attachments. Fig. 2 shows the wall pattern, with ammeter, and clamps for armoured cable. The tripping device is of the free-handle type, and an indicator is provided to show when the switch has opened automatically. The contacts are of the controller finger type, readily renewable. A pedestal type is also made, with or without a bus-bar chamber. The maximum rating of the type is 60 amperes.

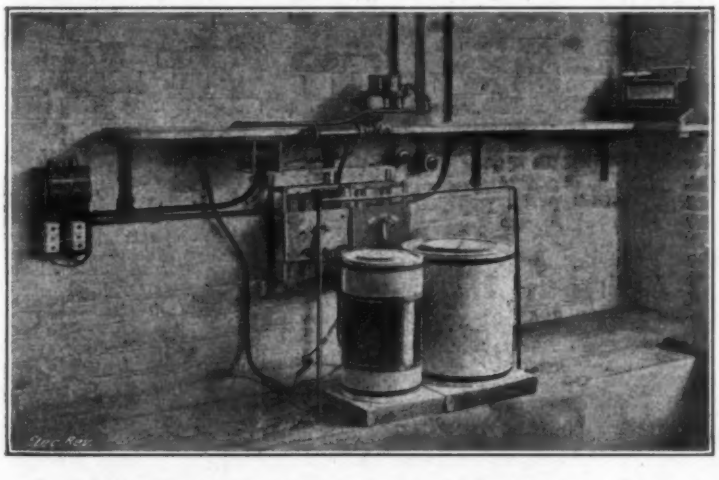

Fig. 1.—Wild-Barfield Installation for Hardening Steel; A.C. Type.

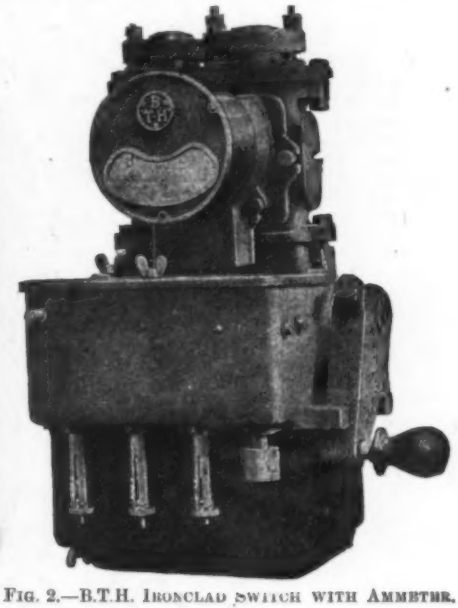

Fig. 2.—B.T.H. Ironclad Switch with Ammeter.

### The Wilkins Truck Unloading Gear.

Messrs. Drake & Gorham, Ltd., of 66, Victoria Street, S.W. 1, have been appointed sole concessionaires for the United Kingdom for the Wilkins unloading gear, a device which at present is being supplied only to the Government for use in connection with road-making, but which will be useful to municipalities which own electric vehicles. It consists of a flexible platform forming the floor of the truck, which can be moved by a drum mounted below

the tail-board, the drum being rotated by handles. The action is similar to that of a chain-grate stoker, and a heavy load can easily be deposited with its aid. It can be applied to existing vehicles without structural changes, and saves both time and labour. Lorry builders who wish to equip their own vehicles can be supplied with the essential parts.

### Tools for Splicing Wire.

Everyone knows what a difficult job it is to splice solid hard-drawn copper or iron wire without suitable tools. In order to obtain a perfect joint, tension must be exerted on the wire ends while winding the splice, and this cannot very easily be done with the common type of cutting pliers. Fig. 3 (1) gives a clear idea of what may be done to overcome the difficulty. A $\frac{5}{16}$-in. hole is drilled in the soft part of one jaw of the pliers. Then by inserting the end of the wire to be wound and rotating the pliers, a perfect tight joint is obtained.

Fig. 3 (2) shows a wire-splicing tool that makes an excellent joint. It winds the joint tight up to the very end of the wire, a result which

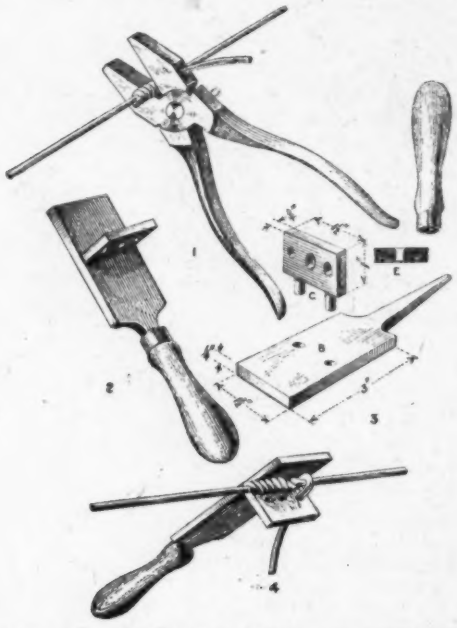


Fig. 3.—Splicing Tools, Parts and Assembly.

cannot be obtained with any kind of pliers. While the joint is being made, the other end of the wire is held by a pair of pliers. The tool consists of a piece of machine steel B, fig. 3 (3), to which a right-angle extension C is riveted. Three holes for the different sizes of wire are drilled, for holding the ends of the wire to be wound on the splice, as shown at 4. The holes for the wire should be well rounded, as shown at E, so as to give the wire a good sliding surface.—M. P. Bertrande, in *Power*.

## NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285 High Holborn, London, W.C., and at Liverpool and Bradford.

2,394. "Electric apparatus for heating liquids." H. C. Sanders. February 11th.

2,415. "Protection of electric supply distribution systems in which shunt wires are employed." A. V. Downton. February 11th.

2,422. "Signalling lamp." G. J. Best and Howes & Burley. February 11th.

2,484. "Electric terminal." Kelvin, Bottomley & Baird, and C. H. Wright. February 12th.

2,494. "Electric current controllers." Y. Uchida. February 12th.

2,508. "Starting devices for internal-combustion engines." F. Allibon. February 12th.

2,514. "Air-cooled sparking plug." A. Gaethofs. February 12th.

2,526. "Apparatus for producing flashes by electric volatilisation of fusible wires." J. Courtier & P. Courtier. February 12th.

2,527. "Ignition devices." F. W. Vickery. February 12th.

2,543. "Device for suppressing earth current in high-voltage systems." Allgemeine Elektricitats Ges. February 12th. (Germany, January 23rd, 1917.)

2,545. "Synchronising or controlling clocks." P. P. Andersen. February 12th.

2,549. "Centrifugal type of mercury cut-out for dynamo-electric machines." N. E. Duffy. February 13th.

2,561. "Insulators for telegraph, telephone, &c., wires." E. D. M. Scrivener, and Taylor, Tunnicliff & Co. February 13th.

2,572. "Cooling alternating-current motors." W. F. Higgs. February 13th.

2,573. "Direct-current electric motors." W. F. Higgs. February 13th.

2,592. "Interrupter for electric circuits." R. Bosch (firm of). February 13th.

2,595. "Fieldless rotary transformer." P. G. Barnes & P. J. Barnes. February 13th.

2,602. "Automatic starting devices for electrically-driven air compressors and pumps." British Thomson-Houston Co. & J. Sugden. February 13th.

2,615. "Alternating-current dynamo-electric machines adapted for synchronous working." L. J. Hunt. February 13th.

2,661. "Sparking plugs for ignition." A. E. Heath. February 14th.

2,664. "Electric motor control systems." J. J. Ash & British Thomson-Houston Co. February 14th.

2,674. "Practice buzzer sets." A. C. Brown. February 14th.

2,676. "Electric conductors." G. Fuller and Fuller Wire & Cable Co. February 14th.

2,685. "Electric selective switching systems and apparatus." F. R. Bullock & International Electric Co. February 14th.

2,693. "Magnetic compasses for aircraft, ships, &c." F. D. Donovan. February 15th.

2,745. "Electric distribution systems." British Thomson-Houston Co. and J. Whitcher. February 15th.

2,746. "Electron discharge devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 15th.

2,757. "Fire-prevention device for electric cables." J. H. Collie and Simplex Conduits, Ltd. February 15th.

2,762. "Three-phase salt-bath electric hardening furnace." J. E. P. Kievits & Kynochs, Ltd. February 16th.

2,768. "Apparatus for demonstrating systems of electric wiring." D. Rowan. February 16th.

2,769. "Measurement or indication of alternating-current quantities." E. Fawssett. February 16th.

2,782. "Ignition devices." E. A. F. Naud. February 16th. (France, January 24th, 1917.)

2,790. "Mouthpiece for use with telephone transmitters." P. Whyball. February 16th.

2,796. "Electric relays." L. F. Blandy & L. B. Turner. February 16th.

2,800. "Electric clocks." P. P. Anderson. February 16th.

## PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

### 1916.

16,423. Sparking Plugs. R. Henry & E. Herrmann. December 2nd, 1915. (102,490.)

### 1917.

999. Dynamo-electric Machinery. Electromotors, Ltd., B. Longbottom and E. Greenhalgh. January 20th, 1917. (112,800.)

1,110. Induction Coils. N. Stell. January 23rd, 1917. (112,803.)

1,113. Method for Guiding the Electric Wire into the Groove of Trolley Wheels of Tramcars and such like Vehicles. T. Main. January 23rd, 1917. (112,804.)

1,315. Ovens and Hot Cupboards Heated by Electricity, Steam, Oil, or Gas. F. P. Fletcher. January 26th, 1917. (112,821.)

1,587. Polyphase Electric Transformers. British Electric Transformer Co. & F. E. Berry January 31st, 1917. (112,829.)

2,623. Tanks for Oil-break Electric Switches. R. W. Gregory and A. Reyrolle & Co. February 22nd, 1917. (112,845.)

3,235. Electric Controllers and the like. G. Ellison & J. Anderson. March 5th, 1917. (Cognate application, 7,372/17.) (112,849.)

4,651. Means for Rendering Water Radio-active. G. E. Heyl & T. T. Baker. March 30th, 1917. (112,865.)

4,739. Protective Gear for Dynamo-electric Generators. H. Pearce. April 2nd, 1917. (112,867.)

7,141. Electric Flashlights. H. Bieber. May 18th, 1917. (112,887.)

7,591. Insulators. J. Sayer. May 26th, 1916. (107,006.)

8,271. Alternating-current Machinery. R. Pohl. June 9th, 1917. (112,890.)

8,690. Reflectors for Electric Bulb Lamps. H. S. Willis & H. A. Taylor. August 11th, 1916. (108,670.)

9,898. Electric Transmission of Signals. E. A. Laidlaw & W. H. Grinsted. July 9th, 1917. (Addition to 1,653/17.) (112,897.)

14,120. Insulators for Telephone, Telegraph, and other Wires. T. Taylor. October 1st, 1917 (112,911.)

14,373. Pocket Flashlamps. H. C. Cloake (C. S. Cloake). December 1st, 1916. (Divided application on 17,275/16.) (112,913.)

14,411. Electrical Transformers and the like. Siemens Schuckertwerke Ges. December 2nd, 1916. (111,837.)

**Electric Pocket Lamps.**—According to a U.S.A. Consular report, a new dry battery for electric pocket lamps has been invented by a citizen of Zurich. Instead of a single block battery, it consists of three distinct elements, which are placed side by side in the metal lamp case. In the event of the battery becoming defective, the voltage of each element is tested to ascertain which one is useless, and it may then be replaced by a single new element. Naturally the cost is considerably reduced. Another important improvement is the possibility of using the new battery in connection with almost any pocket-lamp case now in use. In spite of the exorbitant prices that one must pay now for raw material in Switzerland, the cost of manufacture of this battery is still figured 50 per cent. lower than that of the old battery.

**Electricians' Licences in Johannesburg.**—The Secretary of Public Works and the Master Builders' Association have now agreed upon a scheme for the licensing of electricians contained in by-laws submitted by the Johannesburg T.C.

The licences are to be obtained on examination by the Council, and proof must be given that the candidate has worked for not less than five years as an electrical artisan, including the apprenticeship period. The licensee must conform with the regulations in force within the municipality. A lengthy syllabus is proposed, and the examination is to be held by the authorities of the South African School of Mines and Technology, as in the case of plumbers. A Board of Examiners, representative of the parties concerned, will be formed.